Draft Biological Evaluation for the Cook Inlet Oil and Gas Exploration National Pollutant Discharge Elimination System General Permit

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and

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June 2013

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List of Acronyms

ACC	Alaska Coastal Current
ADEC	Alaska Department of Environmental Conservation
AMAP	Arctic Monitoring and Assessment Program
AMSA	Area Meriting Special Attention
ARRT	Alaska Regional Response Team
ATSDR	Agency for Toxics Substances and Disease Registry
BE	Biological Evaluation
BOEM	Bureau of Ocean Management
CFR	Code of Federal Regulations
COST	Continental Offshore Stratigraphic Test
CWA	Clean Water Act
DPS	Distinct Population Segment
EMP	Environmental Monitoring Program
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
ICS	Incident Command system
LCI	Lower Cook Inlet
MMPA	Marine Mammal Protection Act
MMTPA	Marine Mammal Tissue Archival Project
MSD	Marine Sanitation Device
NEPA	National Environmental Policy Act

NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OCS	Outer Continental Shelf
ODCE	Ocean Discharge Criteria Evaluation
OPA	Oil Pollution Act
OOC	Offshore Operators Committee
PAH	Polynuclear Aromatic Hydrocarbons
PCE	Primary Constituent Element
PPA	Pollution Prevention Act
SGS	State Game Sanctuary
USFWS	U.S. Fish and Wildlife Service
UV	Ultraviolet

List of Units

Bbl	Barrel
bcf	Billion Cubic Feet
dB	Decibel
dB re 1 µPa	Decibels reference 1 micro-Pascal
dB re 20 µPa	Decibels reference 20 micro-Pascal
ft	Feet
gpd	Gallons per day
Kts	Knots
m	Meter
mg/L	Milligrams per liter (ppm)
ml	Milliliter
nm	Nautical miles
ppb	Parts per billion
ppm	Parts per million
rms	Root Mean Square
SEL	Sound Exposure level
SPL	Sound Pressure level
µg/L	Micrograms/liter (ppb)

1.0 Introduction and Background Information

The U.S. Environmental Protection Agency (EPA) has evaluated the potential impacts to federally-listed endangered, threatened and candidate species that could result from the reissuance of the National Pollutant Discharge Elimination System (NPDES) general permit for oil and gas exploration located in Federal water in Cook Inlet, Alaska. The permit authorizes certain discharges of pollutants into Cook Inlet from oil and gas exploration platforms subject to limits and requirements designed to minimize pollution and protect water quality.

Section 7 of the Endangered Species Act (ESA) requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) (collectively the Services) to ensure that any action it authorizes is not likely to jeopardize the continued existence of any species listed under ESA or result in the destruction or adverse modification of critical habitat.

EPA has developed this Biological Evaluation (BE) to assist with consultations for the proposed permit action under ESA Section 7 and Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The BE includes a description of the receiving environment and potential effects (direct and indirect) of the proposed permit action to ESA-listed species under the jurisdiction of both USFWS and NMFS and critical habitat that may be present in the vicinity of the project area.

The federal action discussed in this BE is the reissuance of the NPDES permit for discharges from oil and gas exploration facilities in federal waters of Cook Inlet. EPA’s NPDES permitting program is authorized by Section 402 of the Clean Water Act (CWA, or the Act) and implemented by regulations appearing in Part 122 of Title 40 Code of Federal Regulations (CFR) as well as other Parts of 40 CFR.

1.1 Background

The EPA and Alaska Department of Environmental Conservation (ADEC) propose to reissue the NPDES General Permit for Oil and Gas Exploration Facilities as two general permits, one in State (AKG-31-5100) and one in federal waters (AKG-28-5100) in Cook Inlet.

The existing NPDES General Permit for Oil and Gas Exploration, Development and Production Facilities Located in State and federal waters in Cook Inlet, NPDES Permit No. AKG-31-5000 (2007 GP), expired on July 2, 2012, but continues in effect until reissued. The 2007 Permit authorizes discharges from 19 facilities operated by Hilcorp (formerly Unocal), XTO Energy, Inc., Marathon Oil Company, ConocoPhillips Alaska, Inc., Pioneer Natural Resources, Furie Operating Alaska, LLC (formerly Escopeda), and Buchaneer Alaska Operations, LLC. All of the facilities covered by the 2007 Permit are located in State Waters and will therefore not be considered herein as this BE only evaluates the impact of the proposed action for facilities operating in federal waters.

The EPA has evaluated the potential impacts to federally-listed endangered or threatened species that could result from the reissuance of the Cook Inlet Oil and Gas Exploration General NPDES Permit (hereafter referred to as the GP) for facilities discharging in federal waters of Cook Inlet, Alaska. Exploratory operations are conducted to determine the nature of potential hydrocarbon reserves. Drilling is the main activity during exploratory operations; however there are a number of other inter-related activities that are analyzed in this BE as well. The GP authorized a number of discharges which include:

drilling fluids and drill cuttings	fire control system test water
deck drainage	non-contact cooling water
sanitary wastes	uncontaminated ballast water
domestic wastes	bilge water
desalination unit wastes	excess cement slurry
blowout preventer fluid	mud, cuttings, cement at the seafloor
boiler blowdown	

1.2 Organization of Biological Evaluation

This BE incorporates information presented in the Draft Ocean Discharge Criteria Evaluation (ODCE) for the Cook Inlet Exploration General Permits (USEPA and Tetra Tech 2013). The CWA § 403(c) requires that CWA § 402 NPDES permits comply with EPA's Ocean Discharge Criteria for preventing unreasonable degradation of the marine environment of the territorial seas, the contiguous zones, and the oceans. "Unreasonable degradation of the marine environment" is defined (40 CFR 125.12[e]) as follows:

1. Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities;
2. Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; or
3. Loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge.

The purpose of the ODCE is very similar but broader than the intended purpose of this BE. Nevertheless, there are sections in the ODCE that are compatible with the information that would be contained in the BE. Rather than creating additional redundancy by repeating this information in both documents, the reader is directed to the location within the ODCE. The BE is organized in the following manner:

1) Section 1.0 – Introduction and background Information. This section describes the regulatory authority under which the document is prepared and provides the background information.

2) Section 2.0 – Description of the Proposed Action. This section describes the components of the federal action under consultation.

3) Section 3.0 – Status of the Species and Life History. The majority of the information pertinent to this Section is presented in the ODCE (USEPA and Tetra Tech 2013). These species include those listed as threatened or endangered under the Act and those listed as proposed or candidate species.

4) Species Summary – This brief section provides the rationale for determining which species will be evaluated fully in the BE. The decision was based on information presented in Section 3 as it relates to the potential for species presence in the action area.

5) Section 4 – Environmental Baseline. This Section provides a brief description of the action area and the condition of those factors related to the actions that have been identified as threats to the species.

6) Section 5 – Effects of the Action. This section contains both the exposure and response analysis. In addition to articulating the species potential for exposure in the action area, it includes an analysis of the direct and indirect effects of the proposed action and inter-related actions on the species and their designated critical habitat.

7) Section 6 - Cumulative Effects.

8) Section 7 – Literature cited.

The analogous sections of the ODEC (2013) are presented in the Table 1.

TABLE 1. RELATIONSHIP BETWEEN THE BIOLOGICAL EVALUATION AND THE OCEAN DISCHARGE CRITERIA EVALUATION.

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2.0 Description of the Proposed Action

The existing NPDES GP for Oil and Gas Exploration, Development and Production Facilities Located in State and federal waters in Cook Inlet, NPDES Permit No. AKG-31-5000 (2007 GP), expired on July 2, 2012, but continues in effect until reissued. The scope of the permit herein is scaled back to allow for exploration only in federal water. The focus of this BE is the effect of EPA's issuance of the proposed GP as presented below.

2.1 Scope of the Proposed Action

The proposed GP authorizes discharges from oil and gas extraction facilities engaged in exploration activities in the federal waters of Cook Inlet under the Offshore Subcategory of the Oil and Gas Extraction Point Source Category (40 CFR Part 435, Subpart A).

The Bureau of Ocean Energy Management (BOEM) has completed its Outer Continental Shelf (OCS) Oil and Gas Leasing Program for 2012 to 2017. The Program scheduled 15 potential lease sales in the six offshore areas with the greatest resource potential. The Cook Inlet Planning Areas is included in this program and one special interest sale (Number 244) is scheduled to take place in 2016[1]. The sale is scheduled out to 2016 to allow time to develop additional resource and environmental information and complete the National Environmental Policy Act (NEPA) analysis.

At this point the number of lease blocks that will be available in the sale area (Number 244) is unknown, and so it's difficult to anticipate the number of exploratory wells that will be developed and hence the scope of the action under this proposed GP (which will expire 5 years from the effective date). To add some context to the potential scope, between 1978 and 1985 only 13 exploratory wells were drilled in the federal waters of the Cook Inlet Planning area. Furthermore, in the last 34 years only five sales have been held in Cook Inlet and at most 88 leases were issued in any one sale. However, with the Administration's renewed interest in energy independence it's likely that this number will be greater in future sales should the energy resources be available. Nevertheless, with the sale (Number 244) not scheduled to take place until 2016, it's unlikely that a significant amount of exploration will take place under this proposed GP until late in the 5 year permit term.

2.2 Covered Facilities and Nature of Discharges

See Section 3.0 of the ODCE (EPA and Tetra Tech 2013).

2.3 Project Area

1 http://www.boem.gov/Oil-and-Gas-Energy-Program/Leasing/Five-Year-Program/Lease-Sale-Schedule/2012---2017-Lease-Sale-Schedule.aspx accessed on 9/20/2012 by A. LaTier

The project area is confined to the federal waters of Cook Inlet where the northern boundary is three miles beyond the closure line at Kalgin Island and the southwestern boundary is a line between Cape Douglas and the northernmost tip of Shuyak Island (basically the northern end of Shelikof Strait). All existing production and exploration are located in state waters. Exploration covered under this proposed GP will be authorized within the project area specified above in federal waters of the Cook Inlet Planning Area.

2.4 Conservation measures

There are a number of conservation measures contained in the proposed GP that are designed to avoid and minimize the direct and indirect effects of the proposed action on ESA-listed and candidate species. These measures pertain to specific areas where discharges are prohibited and the types of discharges that are permitted.

2.4.1 Prohibited Areas of the Proposed Cook Inlet Exploration General Permits

EPA proposes to continue the discharge prohibitions from the 2007 NPDES general permit in the following areas (see Figure 1):

- In water depths less than the 10 meter (m) mean lower low water isobath;
- In Kamishak Bay, west of a line from Cape Douglas to Chinitna Point;
- In Shelikof Straits southwest of a line between Cape Douglas and the northernmost tip of Shuyak Island
- Within 20 nautical miles of Sugarloaf Island
  - From latitude 60°04’06” N, longitude 152°34’12” W on the mainland to the southern tip of Chisik Island (latitude 60°05’45” N, longitude 152°33’30” W)
  - From the point on the mainland at latitude 60°13’45” N, longitude 152°32’42” W to the point on the north side of Snug Harbor on Chisik Island (latitude 60°06’36” N, longitude 152°32’54” W).

2.4.2 Prohibited Discharges

Exploratory wells are not expected to extract hydrocarbons therefore, have not been authorized for the discharge of produced waters. The permit contains specific effluent limitations and monitoring requirements for drilling fluid:

1) The discharge of non-aqueous based drilling fluids is prohibited except for situations where such fluids adhere to drill cuttings at facilities located in the Territorial Seas and federal waters, as defined in Appendix A of this proposed GP.

2) The discharge of free oil and diesel oil associated with non-aqueous based drilling fluids is prohibited.

3) The discharge of free oil or diesel oil associated with water-based fluids and cuttings is prohibited.

4) Cadmium and mercury in stock barite, which is added to drilling fluids, are limited to 3 milligram per kilogram (mg/kg) and 1 mg/kg, dry weight, respectively.

5) Only water-based fluids and cutting are allowed to be discharged and then only in waters greater than 10 m in depth.

6) Nonaqueous-based drilling fluids, also known as synthetic-based fluids, are a pollution prevention technology because the drilling fluids are not disposed of through bulk discharge at the end of drilling.

2.4.3 Additional Measures

1) The proposed GP permit limits exploratory operations to a maximum of five wells per site.

2) The proposed GP requires the development and implementation of a Drilling Fluid Plan. This plan is a requirement of the Clean Water Act (CWA §§ 308 and 403) and the Pollution Prevention Act (PPA § 107(b)(3)). The goal of the Plan is to ensure that personnel on-site are knowledgeable about the information needed and the methods required to formulate the drilling fluids/additives systems to meet the effluent toxicity limits and minimize addition of toxic substances.

3) Effluent limitation guidelines include limits for sediment toxicity, biodegradation and polynuclear aromatic hydrocarbons (PAHs). These limits are incorporated into the GP to ensure the use of less toxic fluids that have a higher biodegradation rate.

4) Service helicopters will follow NMFS marine mammal viewing guidelines and regulations, and commit to altitude restrictions (Staying above 1,000 ft) and avoiding flying directly over marine mammals.

5) When safe to do so operate vessels at a slow speed and in a purposeful manner transiting to and from work sites in as direct a route as possible.

6) The permittee will follow the Lighting Guidelines to Avoid Bird Collisions established by USFWS when lighting the drilling structure and when installing any ancillary lighting on structures (Appendix II).

8) The permittee will ensure that all support vessels and aircraft will maintain a 984 ft (300 m) buffer distance from eiders during winter (November 1 to April 30) when birds are resident in lower Cook Inlet (LCI). This measure applies to that portion of the wintering area that overlaps with the federal waters within the action area (See Figure 8). Additionally, aircraft supporting drilling operations will avoid operating below 1,500 ft above sea level over the wintering habitat of Steller's eider.

3.0 SPECIES STATUS AND LIFE HISTORY

Table 2 presents a list of the species, their current status, and notice of the *Federal Register* (FR) final rules that were evaluated in this BE. The list of species is relatively unchanged from the 2006 Biological Evaluation completed in support of the Cook Inlet NPDES general permit (Tetra Tech 2006). However, where appropriate, updates to the status and distribution of these species have been made to reflect current knowledge. Most notable, is the listing of the Cook Inlet population of beluga whales as

Endangered under the ESA and the designation of critical habitat for both Cook Inlet Beluga Whale (CIBW) and the Southwest DPS of the Northern sea otter.

The following sections contain a discussion of each ESA-listed and Candidate species anticipated to be in the Action area and potentially exposed to the proposed action. While there are a number of species that could be present in the vicinity of the Action area, EPA has decided to include only those that have a high likelihood of being present. The probability of likelihood is based on the direct observation, species' range and conclusions that have been made for other actions that have undergone Section 7 consultation in Cook Inlet. All of these points are presented below and a complete discussion of all ESA-listed species considered in this consultation is presented in Section 5.5 of the ODCE (EPA and Tetra Tech, 2013; Table 2).

EPA determined through communication with NMFS that according to the Regional Mark Processing Center Database the Snake River Chinook or Snake River Sockeye have not been detected in Cook Inlet (S. Wright, Biologist, National Marine Fisheries Service, Anchorage, AK, *in Litt*. November 2012). This coupled with the conclusion by NMFS (NMFS *in Litt*. 2006) that "Snake River fall Chinook (*Oncorhynchus tshawytscha*), Snake River spring/summer Chinook [*sic*] salmon… and Snake River sockeye would occur in the project areas, rarely, if at all", led EPA to determine that it was highly unlikely that these species would be present in the Action area and therefore exposed to the proposed action. Table 3 provides the FR notices for critical habitat for these species. Each of these species is discussed in subsequent sections.

TABLE 2. ESA- LISTED AND CANDIDATE SPECIES CONSIDERED IN THIS BIOLOGICAL EVALUATION

Species	***Population/Stock***	***Present Status***	***Federal Register Notice***	
Steller's Eider (*Polysticta stelleri*)	Alaska	Threatened	62 FR 31748	06/11/97
Kittlitz Murrelet (*Brachyramphus brevirostrus*)	Alaska	Candidate	69 FR 24875	05/04/04
Fin Whale (*B. physalus*)	Northeast Pacific	Endangered	35 FR 8491 35 FR 8498	06/02/70 06/02/70
Humpback Whale (*Megaptera novaeangliae*)	Central/Western North Pacific	Endangered	35 FR 8491	06/02/70
Beluga Whale (*Delphinapterus leucas*)	Cook Inlet	Endangered	73 FR 62919	10/22/08
Northern Sea Otter (*Enhydra lutris kenyoni*)	Southwest Alaska	Threatened	70 FR 46366	08/09/05
Steller Sea Lion (*Eumetopias jubatus*)	Western (West of 144 W longitude) Eastern (East of 144 W longitude)	Endangered Threatened	62 FR 24355 62 FR 24345	05/05/97 05/05/97

TABLE 3. SUMMARY OF CRITICAL HABITAT DESIGNATION FOR SPECIES LISTED UNDER THE ESA

Species	*Population*	*Present Status*	*Federal Register Notice*		*Critical Habitat in Alaska (Y/N)*	*Critical habitat in the Action Area (Y/N)*
Steller's Eider	Alaska	Final Rule	66 FR 8849	02/02/01	**Yes**	No
Kittlitz's Murrelet	Alaska	Not Designated	-	-	N/A	N/A
Fin Whale	Northeast Pacific	Not Designated	-	-	N/A	N/A
Humpback Whale	Central North Pacific	Not Designated	-	-	N/A	N/A
Sperm Whale	North Pacific	Not Designated	-	-	N/A	N/A
Beluga Whale	Cook Inlet	Final Rule	76 FR 20180	04/11/11	**Yes**	**Yes**
Northern Sea Otter	Southwest Alaska	Final Rule	74 FR 51988	10/08/09	**Yes**	**Yes**
Steller Sea Lion	Western (West of 144E W longitude)	Final Rule	50 CFR 26.202	05/05/97	**Yes**	No

3.1 STELLER'S EIDER *(POLYSTICTA STELLERI)*

The Alaskan breeding populations of Steller's eider were listed as threatened under the ESA on June 11, 1997 (62 FR 31748). Two breeding populations in Arctic Russia are not part of the ESA listing in the U.S. and are not addressed in this section.

3.1.1 GEOGRAPHIC RANGE AND DISTRIBUTION

The historical breeding range of the Alaska-breeding population of Steller's eider is unclear; it may have extended discontinuously from the eastern Aleutian Islands to the western and northern Alaska coasts, possibly as far east as the Canadian border (66 FR 8850, pg. 8850). In western Alaska, historical (pre-1970) data suggests that the birds formerly nested on the Yukon-Kuskokwim River Delta (Y-K Delta) and at least occasionally at other western Alaska sites, including the Seward Peninsula, St. Lawrence Island, and possibly the eastern Aleutian Islands and Alaska Peninsula. Currently, breeding occurs in two general areas the Arctic Coastal Plain on the Alaskan North Slope and to a lesser extent on the Y-K Delta in western Alaska (66 FR 8850, pg. 8850).

The Arctic Coastal Plain, particularly the area surrounding Barrow, is extremely important to nesting Steller's eiders (USFWS 2002, pg. 8). Aerial surveys conducted from 1999 to 2002 in a 2,757 km^2 area from Barrow south to Meade River recorded between two to over 100 breeding pairs for a maximum density of 0.08 birds/km^2 (USFWS 2002, pg. 6). In contrast, only seven nests were found on the Y-K Delta from 1994 to 2002 (USFWS 2002, pg.8).

After breeding, Steller's eiders move to marine waters where they molt and remain flightless for about three weeks. The birds, which presumably consist of members of both Alaskan and Russian populations, primarily molt in areas along the north side of the Alaska Peninsula, in Izembek Lagoon, Nelson Lagoon, Port Heiden, and Seal Islands (USFWS 2002, pg. 6). After molting, many Steller's eiders disperse to the Aleutian Islands, the south side of the Alaska Peninsula, Kodiak Island, and as far east as Cook Inlet. Wintering birds usually occur in waters less than 9.1 m (30 ft) deep and are, therefore, usually found within 400 m (400 yd) of shore except where shallows extend further offshore in bays and lagoons (USFWS 2002, pg. 7).

The winter range from the Kodiak Island east to LCI overlaps the geographical area of the NPDES general permit. Birds from Alaskan and Russian breeding populations intermix on the wintering grounds; however, it's unclear what percent of the wintering birds comprise the ESA-listed population (Alaskan breeding population). According to the USFWS, about 4.2 percent of the Steller's eider in or near the Cook Inlet area is assumed to be from the Alaskan breeding population (MMS 2003, pg. 94).

3.1.2 CRITICAL HABITAT

Designated critical habitat for the Steller's eider includes five units located along the Bering Sea and north side of the Alaskan Peninsula. These areas are the Delta, Kuskokwim Shoals, Seal Islands, Nelson Lagoon, and Izembek Lagoon (66 FR 8850, pg. 8850). Within these areas, the primary habitat components that are essential include areas to fulfill the biological needs of feeding, roosting, molting, and wintering. Important habitats include the vegetated intertidal zone and marine waters up to 30 ft (9.1 m) and the underlying substrate and benthic community and where present eelgrass beds and associated biota (66 FR 8850 pg. 8857). No critical habitat is designated within the action are of the proposed GP.

3.1.3 Life History

Steller's eiders exhibit strong fidelity to wintering and molting (Flint et al. 2000, pg. 262) areas. Courtship begins in late winter and most pair formation occurs prior to dispersal toward breeding grounds (McKinney 1965, pg. 273). Wintering aggregations on the Alaska Peninsula begin migrations in mid- to late-April, with large numbers departing from Izembek in a matter of days (McKinney 1965, pg. 273) (Laubhan and Metzner 1999, pg. 696). Steller's eider nest on tundra adjacent to small ponds or drained basins in locations generally near the coast, but ranging at least as far as 90 km (56 mi) inland (USFWS 2002, pg. 6). Young hatch in late June and feed in wetlands on aquatic insects and plants until they are capable of flight in about 40 days. After breeding, Steller's eiders move to marine waters of southwest Alaska, including Cook Inlet, where they molt from late July to late October. After molting most birds disperse to winter in shallow, sheltered waters along the south side of the Alaska Peninsula, Kodiak Island, and as far east as Cook Inlet (USFWS 2002, pg. 7). The number of Steller’s eiders in Cook Inlet increases through early winter peaking in January and February before the spring migration to nesting grounds (Larned 2006, pg 23). While in marine waters, Steller's eider forage primarily on mollusks and crustaceans.

3.1.4 Population Trends and Risks

Evidence suggests that the breeding range of Steller’s eiders in Alaska has substantially contracted, with the species disappearing from much of its historical range in western Alaska (Dau et al. 2000, pg. 541). The size of the breeding population on the Alaskan North Slope shows considerable variation among years, and it is not known whether the population is currently declining, stable, or improving (65 FR 13262). Determining population trends for Steller's eider is difficult due to the inherent problems of conducting aerial bird counts and the lack of a species-specific correction factor to apply to the resulting data (65 FR 13262). However, counts conducted in 1992 indicate that at least 138,000 birds winter in southwest Alaska; although the proportion belonging to the Alaska-breeding population versus those from Russian-breeding populations is uncertain (USFWS 2002, pg. 17). More specifically, Larned (2006, pg. 4) estimated winter populations of 1,247 and 4,284 eiders in the eastern and western portions of Cook Inlet, respectively. High abundances were found along nearshore areas of the eastern portion of Cook Inlet from Anchor Point to 25 km north of Ninilchik and from Homer Spit to Anchor Point. To the west, important areas include southern Kamishak Bay from Douglas River to Bruin Bay, including the shoreline between Bruin Bay and Ursus Cove, and a shoal 12 km southeast of Bruin Bay and the mouth of Iniskin Bay.

The Alaska-breeding population of the Steller's eider is considered to be at risk. The destruction or modification of habitat is not thought to have contributed to the decline of the species; however, numerous factors are detailed in USFWS (2002, pg. 10), including:

- Exposure to lead through ingestion of spent lead shot when foraging may pose a significant health risk to Steller's eiders.

- Although there is no information to suggest that disease contributed to the decline of Steller's eiders, recent sampling suggests that Steller's eiders and other sea ducks in Alaska may have significant exposure rates to a virus in the family Adenoviridae.

- Changes in predation pressure in breeding areas are hypothesized to be the cause of the near disappearance of birds on the Y-K Delta. Recent studies within the primary breeding area on the North Slope near Barrow suggest that nest success is very poor and predation is thought to be the primary factor.

Although hunting of Steller's eider is prohibited under the Migratory Bird Treaty Act, some intentional or unintentional shooting occurs.

3.2 Kittlitz's Murrelet

The Kittlitz's murrelet (*Brachyramphus brevirostrus*) is a candidate for listing under the ESA as of May 9, 2001 under its entire range. This designation indicates that preparation and publication of a proposal for listing as endangered or threatened has been precluded by listing actions of higher priority.

3.2.1 Geographic Range and Distribution

The Kittlitz's murrelet is a small, diving seabird found only in Alaska and the Russian Far East. This species ranges discontinuously from Point Lay in the north to Glacier Bay and Southeast Alaska. The largest known populations occur in Glacier Bay and Prince William Sound, where dramatic population declines have been observed over the past decade. During summer, the Kittlitz's murrelet forages almost exclusively at the face of tidewater glaciers or near the outflow of glacier streams, and steep barren mountainsides and talus slopes above timberline, generally near glaciers and cirques. Little is known about the winter range of this species, but it is likely pelagic (Day et al. 1999).

3.2.2 Critical Habitat

No critical habitat has been designated for this species.

3.2.3 Life History

The life history of the Kittlitz's murrelet is largely unknown. This species is closely associated with marine tidewater glaciers and glacially influenced waters and is often found in protected fjords or among islands where breeding occurs from May to June. Kittlitz's murrelets move into glacially influenced marine waters in south central and southeast Alaska starting in April, they depart these areas in late July to early August for wintering habitat possibly located in the Bering Sea (Day et al. 1999; Kuletz et al. 2011) (Day et al. 1999, p. 3; 2010; Kissling et al. 2007, pp. 2167–2168; Kuletz and Lang 2010,pp . 39–43; Day et al. in press). However, some individuals are year-round residents in these areas as documented through winter sightings in southeast, south central and western Alaska, (Kendall and Agler 1998, pg. 55; Day et al. 1999, pg. 4; Stenhouse et al. 2008, pg. 61).

During the breeding-season, Kittlitz's murrelets appear to favor waters greater than 200 m from shore. Nests are generally located on bare ground, near glaciers or cirques and can be located as much as 305 m to 914 m (1,000 ft to 3,000 ft) above sea level and several miles inland. The diet of the Kittlitz's murrelet consists of fish and macrozooplankton. Birds have been sighted in winter in the northern Gulf of Alaska and south coastal Alaska. During the non-breeding season this species appears to use waters farther offshore, such as the Alaska Coastal Current and mid-shelf regions.

3.2.4 Population Trends and Risks

Based on various surveys conducted over the past 2 decades USFWS estimated the total Alaska population of Kittlitz's murrelets at approximately 5,373 individuals, with a range of 9,505 to 26,767 individuals (USFWS 2002). USGS surveys conducted in Prince William Sound (1999 and 2000), Glacier Bay (2001), Malaspina Forelands (2002), and Icy Bay (2002) identified these areas as important population centers of the Kittlitz's murrelet population in North America. Population declines have been documented in each of these areas and have been attributed to anthropogenic factors (e.g., marine oil pollution and vessel traffic) in Prince William Sound and Glacier Bay where human activity is more prevalent, and climate related causes in Malaspina Forelands and Icy Bay.

Due to its limited range and marine, coastal distribution, major threats to the Kittlitz's murrelet include oil spills; drowning in nearshore salmon gillnet fisheries, and disturbance due to cruise ship traffic in glaciated fjords. The greatest threat to this species may be the pervasive effects of climate change on tidewater glaciers, many of which are now receding.

3.3 Humpback Whale (*Megaptera novaeangliae*)

Humpback whales were listed as endangered throughout their range on June 2, 1970 under the ESA (35 FR 8491) and are considered "depleted" under the Marine Mammal Protection Act.

3.3.1 Geographic Boundaries and Distribution

The humpback whale is distributed worldwide in all ocean basins, although it is less common in Arctic waters. Currently there are five recognized stocks of humpback whales in U.S. waters based on geographically distinct winter ranges: Gulf of Maine stock, central North Pacific stock, the western North Pacific stock, California, Oregon and Washington and American Samoa[2]. The central and western North Pacific stocks inhabit Alaskan waters. In Alaskan waters, most humpbacks tend to concentrate in southeast Alaska, Prince William Sound, the area near Kodiak and Barren Islands, the area between the Semidi and Shumagin Islands, eastern Aleutian Islands, and the southern Bering Sea (ADFG 1994b). In inside waters off southeastern Alaska (i.e., Glacier Bay and Frederick Sound) photo-identification studies summarized by Perry (1999, pg. 24) appear to show that humpback whales use discrete, geographically isolated feeding areas that individual whales return to year after year. These studies find little documented exchange in individual animals between Prince William Sound areas and the Kodiak Island area and between the Kodiak Island area and southeast Alaska feeding areas, suggesting that while movement among these areas may occur, it is uncommon.

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[2] http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/humpbackwhale.htm#description accessed on 9/25/12 by A. LaTier

Although humpback whales can be observed year-round in Alaska, most animals migrate during the fall to temperate or tropical wintering areas where they breed and calve. Most whales that spend the summer in Alaskan waters are thought to migrate to overwinter in waters near Hawaii (ADFG 1994b; Perry et al. 1999, pg. 24). Feeding occurs preferentially over continental shelf waters (Gregr and Trites 2001, pg. 1273) and is often observed relatively close to shore, including cold productive coastal waters[2]. In the summer, humpback whales are regularly present and feeding in areas near and within Cook Inlet, including Shelikof Strait, bays of Kodiak Island, and the Barren Islands, in addition to the Gulf of Alaska adjacent to the southeast side of Kodiak Island (especially Albatross Banks), the south sides of the Kenai and Alaska peninsulas, and south of the Aleutian Islands. There is some evidence of a discrete feeding aggregation of humpbacks in the Kodiak Island region. Humpbacks also may be present in some of these areas throughout the autumn. Large numbers of humpbacks have been observed in late spring and early summer feeding near the Barren Islands. Humpbacks have also been observed feeding near the Kenai Peninsula north and east of Elizabeth Island (MMS 2003, pg. III-73).

3.3.2 Critical Habitat

No critical habitat has been designated for the humpback whale.

3.3.3 Life History

Humpback whales are seasonal migrants. The whales mate and give birth while in wintering areas outside of Alaskan waters. Sexual maturity occurs between the ages of 4 and 6 years, with mature females giving birth every 2 to 3 years (ADFG 1994b). During spring, the whales migrate back to feeding areas in Alaskan waters, where they spend the summer (ADFG 1994b; Perry et al. 1999, pg. 32).

Humpback whales use a variety of feeding behaviors to capture food, including underwater exhalation of columns of bubbles that concentrate prey, feeding in formation, herding of prey, and lunge feeding (ADFG 1994b). Based on their diet, humpbacks have been classified as generalists (Perry et al. 1999, pg. 32). They have been known to prey upon euphausiids (krill), copepods, juvenile salmonids (*Oncorhynchus* spp.), Arctic cod (*Boreogadus saida*), capelin, Pacific herring (*Clupea harengus pallasi*), sand lance (*Ammodytes hexapterus*), walleye Pollock, pollock (*Pollachius vixens*), pteropods, and some cephalopods. On Alaska feeding grounds, humpback whales feed primarily on capelin, juvenile walleye pollock, sand lance, Pacific herring, and krill (Perry et al. 1999, pg. 32).

3.3.4 Population Trends and Risks

The population of humpback whales living in the North Pacific is estimated at about 20,000 (Calambokidis et al. 2008, pg. 3). Summer feeding areas of Alaska were surveyed by different researchers, and observations include humpback whales in Prince William Sound, in the Shumagin Islands, in the Bering Sea, and coastal shelf waters in the Gulf of Alaska/Aleutian Islands (Calambokidis et al 2001; Allen and Angliss 2011). The recent population survey observed "63 humpback whales in the Aleutian Islands, 491 in the Bering Sea, 301 in the western Gulf of Alaska (including the Shumagin Islands), and 1,038 in the northern Gulf of Alaska (including Kodiak and Prince William Sound" (Calambokidis et al. 2008, Table 10).

Historic and current risk factors influence the population and well-being of humpback whales. Commercial whaling harvested more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 individuals after the 1965 hunting season[3] (Rice 1978 cited in Allen and Angliss 2011, pg. 177). Presently, commercial fisheries may pose a risk to humpback whales. Between 2007 and 2009 no mortalities or serious injuries were reported (Allen and Angliss 2011, pg. 176).

Anthropogenic sources of noise are another source of risk to whale populations. Humpbacks exhibit variable responses to noise, and the level and type of response exhibited by whales has been correlated to group size, composition, and apparent behaviors at the time of possible disturbance. Humpback whales have suffered severe mechanical damage to their ears from noise pulses from underwater blasting; whales exposed to playbacks of noise from drillships, semisubmersibles, drilling platforms, and production platforms do not exhibit avoidance behaviors at noise levels up to 116 dB (Malme et al. 1985, pg. VII). Other potential risks to humpback whales include habitat degradation, exposure to contaminants and resource competition (NMFS 1991, pg. 25).

3.4 Fin Whale (*Balaenoptera physalus*)

Fin whales were first listed on June 2, 1970 under the Endangered Species Conservation Act of 1969 (35 FR 8491) and are currently designated as endangered in their entire range under the Endangered Species Act of 1973 and "depleted" under the MMPA. Three stocks of fin whales are currently recognized in U.S. Waters including Alaska (Northeast Pacific), California, Washington, Oregon, and Hawaii. However, new data from (Mizroch et al. 2009, pg. 193) suggest the existence of two migratory stocks (eastern and western Pacific) and two to four stocks that occur in peripheral seas, including the Gulf of California, East China Sea, Sanriku-Hokkaido and possibly in the Sea of Japan.

3.4.1 Geographic Boundaries and Distribution

Fin whales are somewhat common in outer Prince William Sound and along the south coasts of the Alaska Peninsula, near the Aleutian Islands, and along the continental shelf in the Bering Sea, particularly in proximity to the Pribilof Islands (Leatherwood et al. 1982, pg. 24). Rice (1974 pg. I-13 as cited in NMFS 2006) reported summer distributions along nearshore areas from central Baja California to Japan, and extending north as far as Chukchi Sea.

Fin whales are believed to feed preferentially along offshore waters, with preferred habitat encompassing a large area that includes the continental shelf break and offshore waters (Gregr and Trites 2001, pg. 1271). Fin whales regularly inhabit areas near the action area, including Shelikof Strait, bays along Kodiak Island (especially Uganik and Uyak bays on the west side), and the Gulf of Alaska. Some or all of these locations are known feeding areas. Sighting data suggest that the distribution and abundance of fin whales in these areas vary seasonally, but there is documented use in the vicinity of Kodiak Island every month of the year except December and January (MMS 2003, pg. III-87).

[3] http://www.nps.gov/glba/naturescience/whales.htm accessed on 9/26/12 by A. LaTier

3.4.2 Critical Habitat

No critical habitat has been designated for the fin whale.

3.4.3 Life History

Fin whales tend to be more social than other rorquals, gathering in pods of two to seven whales or more. Reproductive activity generally occurs in winter following migration to warmer waters. Sexual maturity occurs at the ages of six to 10 years in males and seven to 12 years in females, and species may live as long as 90 years[4]. Ohsumi (1986 pg. I-15; cited in NMFS 2006) found that the species exhibits a dramatic response to exploitation pressures. Data from the mid-1950s to 1975 indicate a decline in the average age of sexual maturity from 12 to 6 years in females and from 11 to 4 males in males. Ohsumi concluded the decline to be a density dependent response to intense harvesting of the population.

Fin whales feed on a variety of euphausiids (*Euphausia pacifica*, *Thysanoessa longipes*, *T. pinifera*, and *T. inermis*) and large copepods, primarily *Calanus cristatus* (Kawamura 1982, pg. 59; Nemoto 1970 pg. I-15 cited in NMFS 2006). The species is also known to forage on schooling fish, such as herring (*Clupea sp*.), walleye pollock (*Theragra chalcogramma*), and capelin (*Mallotus vilosus).*

3.4.4 Population Trends and Risks

For the entire North Pacific population, abundance estimates range from 42,000 to 45,000 individuals prior to commercial exploitation, and from 14,620 to 18,630 individuals in the early 1970s (Ohsumi and Wada 1974 as cited in Barlow 1994, pg. 10). In Alaska, surveys conducted in 1994 covering 2,050 nm of track line south of the Aleutian Islands encountered only four fin whale groups. Results of surveys in the central-eastern and southeastern Bering Sea conducted in 1999 and 2000 provided estimates of 3,368 and 683, respectively, although these are conservative uncorrected estimates (i.e., no adjustments made for whales missed during the survey) (Moore et al. 2002). Additional sighting cruises were conducted in coastal waters of western Alaska and the eastern and central Aleutian Islands in July-August 2001-2003 between the Kenai Peninsula (150 °W) and Amchitka Pass (178 °W) that detected 1,652 whales (Zerbini et al. 2006, pg. 1772). Together these survey results combine for a minimum population estimate of 5,703 whales.

The risk of human-related mortality is relatively low for fin whales. Prior to 1999, no injuries or mortality associated with commercial fishing had been reported for the North Pacific Stock. There was one mortality associated with the Gulf of Alaska pollock trawl fishery occurred in 1999. Ship strikes appear infrequent with one strike in Uyak Bay reported between 1997 and 2001. Fin whales in the Alaska stock are not harvested for subsistence and no habitat-related limiting factors have been identified for this species (Angliss and Outlaw 2005, pg. 184).

3.5 Cook Inlet Beluga Whale (*Delphinapterus leucas*)

There are five stocks of beluga whales that inhabit U.S. waters, all of which occur near Alaska. These include the Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, Bristol Bay, and Cook Inlet Stocks. The Cook Inlet Beluga was listed by the NMFS as endangered under the ESA in 2008 (73 FR 62919). This

[4] http://seamap.env.duke.edu/species/tsn/180527

stock was also designated as "depleted" under the MMPA as of May 3, 2000 (65 FR 34590), however NMFS decided not to list it under the ESA at that time (65 FR 38778) primarily because subsistence harvest, which was thought to be the primary limiting factor of that population was halted in 1999.

3.5.1 Geographic Boundaries and Distribution

Beluga whales occur in Arctic waters of the northern hemisphere, living in openings within the pack ice in winter and migrating to shallow bays and estuaries in summer. Beluga whales range from Yakutat to the Beaufort Sea. Some beluga stocks migrate over thousands of miles moving from the Bering Sea to the Mackenzie River estuary in Canada (ADFG 2008). The winter distribution of the Cook Inlet stock is unknown, but few beluga whales have been observed in the Gulf of Alaska outside the inlet. According to the National Oceanic and Atmospheric Association (NOAA) (Allen and Angliss 2011, pg. 84) some if not all of this population occupy Cook Inlet throughout the year. In spring, Cook Inlet beluga whales move toward the upper portions of the inlet where they occur in coastal areas, particularly near the mouths of rivers (Rugh et al. 2000 cited in Allen and Angliss 2011, pg. 84). Large groups may remain in and near the Susitna River, Little Susitna River, Beluga River and the Turnagain Arm (Moore et al. 2000, pg. 63). Beluga whales are known to move up rivers including those feeding Cook Inlet; individuals from northern stocks have been observed in the Yukon River as far upstream as Tanana, Rampart, and Fort Yukon (ADFG 2008).

3.5.2 Critical Habitat

Effective May 11, 2011, two areas comprising 7,800 km^2 (3,013 mi^2) were designated as critical habitat for beluga whales (76 FR 20180). Area 1 includes 1,909 km^2 (738 mi^2) of Cook Inlet northeast of a line from the mouth of Threemile Creek to Point Possession. The area provides important foraging and calving habitats, experiencing the greatest concentrations of belugas from spring through fall. Area 2 comprises 5,891 km^2 (2,275 mi^2) and is located to the south of Area 1. It includes nearshore areas along the west side of the Inlet and Kachemak Bay on the east side of the lower inlet.

3.5.3 Life History

Beluga whales are small with adult whales generally ranging in size from 12 to 14 feet and females reaching 12 feet (ADFG 2008; NOAA 2008, pg. 3-3). Calves are born dark gray to brownish-gray with the color lightening to a yellow-white in adulthood. Reports of sexual maturity range from four to eight years (ADFG 2008; NOAA 2008, pg. 3-17). Calves are born in late spring and early summer, usually in the summer concentration areas following a 14-month gestation period (ADFG 2008). Adult females typically produce offspring once every 3 years. Members of the Cook Inlet stock have been observed calving in Kachemak Bay, off the mouths of the Beluga and Susitna Rivers, and in the Turnagain Arm (Funk et al. 2005, pg. 2-11; NOAA 2008, pg. 3-17).

Belugas are social and are frequently observed in groups ranging in size from two to five to pods of more than 100 individuals. They are known to vocalize using grunts, clicks, chirps, and whistles to navigate, find prey, and communicate. During summer months, they are often found in shallow waters where they feed on schooling and anadromous fish including herring, capelin, eulachon, salmon and sculpins (ADFG 2008). They are also known to eat octopus, squid, crabs, shrimp clams, mussels and sandworms (Moore et al. 2000, pg. 68; Funk et al. 2005, pg. 2-13; NOAA 2008, pg. 3-43) .

3.5.4 Population Trends and Risks

NMFS stock assessment reports for 2011 estimate the combined population of the five beluga whale stocks in U.S. waters at slightly over 55,000 individuals[5]. NMFS reports that the population trends for the Beaufort Sea and Eastern Bering Sea stocks are unknown; these two stocks account for over 90 percent of the estimated population of beluga whales in U.S. waters (Allen and Angliss 2010, pg. 67; Allen and Angliss 2011, pg. 76). The population of the Eastern Chukchi stock consisting of 3,710 individuals shows no evidence of decline and NMFS considers the population of the Bristol Bay stock (2,467) to be increasing (Allen and Angliss 2010, pg. 71; Allen and Angliss 2011, pg. 80). The most recent surveys of the Cook Inlet population (2010) survey is 340 animals and is consistent with the continued declining trend for this stock (Allen and Angliss 2011, pg 85)

NMFS included the Cook Inlet stock beluga whale stock on the candidate list of threatened and endangered species in 1991. No further action was taken immediately following, although NMFS received two petitions in 1999 to list the Cook Inlet stock under the ESA (65 FR 38778) resulting in the Cook Inlet stock being designated as depleted under the MMPA (65 FR 34590). Subsequent investigations assessed natural and human-induced sources of potential impacts that included:

- Habitat capacity and environmental change
- Stranding events
- Predation
- Subsistence harvest
- Commercial fishing
- Oil and gas development

The investigations concluded that subsistence harvests presented the most immediate threat to the stock. Although NMFS found that other potential sources of impact could have some negative effect on recovery, none were considered significant (65 FR 38778). Between 2000 and 2005 co-management agreements between NMFS and the Cook Inlet Marine Mammal Council have allowed one to two beluga whales to be harvested annually. As a result of a high number of mortalities in 2004 (20 whales), NMFS requested that the Marine Mammal Council refrain from harvest that year. NMFS developed the *Draft Conservation Plan for the Cook Inlet Beluga Whale (Delphinapterus leucas)* in 2005 to establish goals and objectives that can be achieved cooperatively to promote the recovery of the Cook Inlet beluga whale population. The goals and objectives apply to a range of potential sources of impacts including those identified above as well as shoreline development, vessel traffic, and noise. The lack of evidence that the population is recovering even with the co-management agreements in place led NMFS to announce in March 2006 that they would be reviewing the status of Cook Inlet beluga stock under the ESA.

3.6 Northern Sea Otter (*Enhydra lutris kenyoni*)

The USFWS issued a final rule listing the southwest Alaska distinct population segment of the northern sea otter as threatened under the ESA on August 9, 2005 (70 FR 46366).

[5] http://www.nmfs.noaa.gov/pr/sars/species.htm#beluga accessed on 10/10/12

3.6.1 Geographic Boundaries and Distribution

According to various range maps the overall range of the sea otter extends from northern Japan to southern California. There are three recognized subspecies of *Enhydra lutris. E. lutris kenyoni,* referred to as the northern sea otter, has a range that extends from the Aleutian Islands in southwestern Alaska to the coast of the state of Washington (USFWS 2005) (Figure 2).

Northern sea otters occur in nearshore waters which allow them access to subtidal and intertidal foraging habitat. Visual observation of 1,251 sea otter dives in southeast Alaska, indicates that foraging activities typically occurs in water depths ranging from 2 to 30 m (7 to 98 ft), although foraging at depths up to 100 m (328 ft) was observed (Bodkin et al. 2004).

Sea otter movements are influenced by local climatic conditions such as storm events, prevailing winds and tidal conditions in some areas. The animals usually do not migrate and seldom travel unless an area has become overpopulated and food is scarce.

The home ranges of sea otters in established populations are relatively small. Sexually mature females have home ranges of 8 to 16 km (5 to 10 miles). Breeding males remain for all or part of the year within the bounds of their territory, which constitutes a length of coastline from 100 m (328 ft) to 1 km (0.6 mi). Male sea otters that do not hold territories may move greater distances between resting and foraging areas than territorial males (70 FR 46367)**Error! Bookmark not defined.**.

3.6.2 Critical Habitat

On October 8, 2009, approximately 15,164 km^2 (5,855 mi^2) of critical habitat was designated for the northern sea otter (74 FR 51988). Five distinct units were identified, including: Unit 1 - Western Aleutian, Unit 2 - Eastern Aleutian, Unit 3 - South Alaska Peninsula, Unit 4 - Bristol Bay and Unit 5 - Kodiak, Kamishak, Alaska Peninsula. The Bristol Bay unit is further subdivided in 3 subunits (Amak Island, Izembek Lagoon and Port Moller/Herendeen Bay). Unit 5, the largest of the designated areas, ranges from Castle Cape in the west to Tuxedni Bay in the east, and includes the Kodiak archipelago. It contains all the Primary Constituent Elements (PCEs) necessary for the conservation of the southwest Alaska northern sea otter population and thus is subject to special management considerations and protections to minimize the risk of oil and other hazardous-material spills from commercial shipping (74 FR 51988)**Error! Bookmark not defined.**.

3.6.3 Life History

Sea otters mate at all times of the year, and young may be born in any season; however, in Alaska, most pups are born in late spring (ADFG 2008). Females typically give birth in the water, although they have been observed giving birth on shore (70 FR 46367)[6]. Male sea otters appear to reach sexual maturity at five to six years of age, and have a lifespan of about 10 to 15 years. Female sea otters reach sexual maturity at three to four years of age and have a lifespan of about 15 to 20 years (70 FR 46367)**Error! Bookmark not defined.**. Sea otters are gregarious and may become concentrated in an area, sometimes resting in pods of fewer than 10 to more than 1,000 animals (ADFG 2008).

[6] http://www.gpo.gov/fdsys/pkg/FR-2005-08-09/pdf/05-15718.pdf

The search for food is one of the most important daily activities of sea otters, as large amounts are required to sustain the animal in healthy condition. Sea urchins, crabs, clams, mussels, octopus and other marine invertebrates make up the normal diet of sea otters (ADFG 2008).

3.6.4 Population Trends and Risks

Prior to commercial exploitation, the world population of sea otter in the North Pacific Ocean was estimated to be between 150,000 and 300,000 individuals (70 FR 46367)**Error! Bookmark not defined.**. Over the 170 years of commercial exploitation, sea otters were hunted to the brink of extinction first by Russian and later by American fur hunters. Sea otters became protected under the International Fur Seal Treaty of 1911 and at that time the entire population may have been reduced to fewer than 1,000 individuals (USFWS 2010, pg. iii).

By the 1980s, sea otters in southwest Alaska had increased in abundance and re-colonized much of their former range. However, aerial surveys conducted in 2000 indicated widespread declines throughout the Aleutian Islands, particularly in the central Aleutians. Doroff et al. (2003, pg. 55) estimated that sea otter populations had decreased approximately 70 percent from a similar survey conducted in 1992. At present, the population in southwest Alaska is estimated at 53,674 animals (USFWS 2010, pg. 2-22); 54 percent (28,955 animals) of this total occurs within the Kodiak Archipelago. Throughout the remainder of their range, sea otter populations have declined in the range of 39 percent to 74 percent.

3.7 Steller Sea Lion *(Eumetopias jubatus)*

The NMFS listed Steller sea lion as threatened, by emergency interim rule, on April 5, 1990 (55 FR 12645). The emergency rule listing, which had duration of 240 days, was followed by a final listing of Steller sea lion as threatened on November 26, 1990 (55 FR 49204). On May 5, 1997, the NMFS issued a final rule that reclassified Steller sea lions into two distinct population segments (62 FR 24355). The Steller sea lion population west of 144°W longitude (a line intersecting the Alaskan coastline near Cape Suckling) was reclassified as endangered; the sea lion population to the east of this line retained its ESA-listing status as threatened; both stocks are therefore designated as "depleted" under the MMPA.

3.7.1 Geographic Boundaries and Distribution

The Steller sea lion is distributed around the North Pacific Ocean rim from northern Hokka, Japan along the western North Pacific northward through the Kuril Islands and Okhotsk Sea, then eastward through the Aleutian Islands and central Bering Sea, and southward along the eastern North Pacific to the Channel Islands, California (NOAA 2012). Two distinct populations (western and eastern) are thought to occur within this range, with the dividing line being designated as 144°W longitude (62 FR 24355).

3.7.2 Critical Habitat

In 1993, NMFS issued a final rule designating critical habitat for the Steller sea lion, including all U.S. rookeries, major haulouts in Alaska, horizontal and vertical buffer zones (5.5 km) around these rookeries and haulouts, and three aquatic foraging areas in north Pacific waters: Sequam Pass, southeastern Bering Sea shelf, and Shelikof Strait (58 FR 45269). This final rule was amended on June 15, 1994 to change the name of one designated haulout site from Ledge Point to Gran Point and to correct the longitude and latitude of 12 haulout sites, including Gran Point (59 FR 30715).

Critical habitat includes a terrestrial zone that extends 0.9 km (3,000 ft) landward from the baseline or base point of each major rookery and major haulout in Alaska. Critical habitat includes an air zone that extends 3,000 ft. (0.9 km) above the terrestrial zone of each major rookery and haulout area measured vertically from sea level. Critical habitat within the aquatic zone in the area east of 144 °W longitude (ESA threatened population) extends 0.9 km (3,000 ft) seaward in state and federally managed waters from the base point of each rookery or major haulout area. Critical habitat within the aquatic zone in the area west of 144 °W longitude (ESA endangered population) extends 37 km (20 nm) seaward in state and federally managed waters from the baseline or base point of each rookery or major haulout area (58 FR 45269) (Figure 3).

3.7.3 Life History

The breeding season for Steller sea lions is from May to July, where the animals congregate at rookeries and the males defend territories, mating occurs, and the pups are born. Non-reproductive animals congregate to rest at more than 200 haulout sites where little or no breeding occurs. Bulls become sexually mature between three and eight years of age, but typically are not able to gain sufficient size and successfully defend territory within a rookery until nine to ten years of age. Females reach sexual maturity and mate at between four and six years of age and typically bear a single pup each year. Sea lions continue to gather at both rookeries and haulout sites throughout the year, outside of the breeding season (ADFG 1994). Habitat types that typically serve as rookeries or haulouts include rock shelves, ledges, slopes, and boulder, cobble, gravel, and sand beaches. Seasonal movements occur generally from exposed areas in summer to protected areas in winter (NOAA 2012).

When foraging in marine habitats, Steller sea lions typically occupy surface and mid water ranges in coastal regions. They are opportunistic predators and feed on a variety of fish (walleye Pollock, Atka mackerel *(Pleurogrammus monopteryguius),* Pacific herring, capelin, sand lance, Pacific cod *(Gadus macrocephalus),* and salmon), and invertebrates (squid, octopus) (ADFG 1994; NOAA 2012).

3.7.4 Population Trends and Risks

Thirty years ago the US population of Steller sea lions was estimated to be 192,000 adults and juveniles (NOAA 2012 pg.7). The western population of Steller sea lion declined approximately 5.0 percent per year over the period of 1991 to 2000, while the eastern population has increased at about 1.7 percent per year (Loughlin and York 2000, pg. 41). Based on data collected in 2003 and 2004, Fritz and Stinchcomb (2005, pg. 11) cautiously concluded that the decline of the western population within the Alaskan territory has slowed and showed a modest increase estimated at 2.4 to 4.2 percent. More recent surveys appear to confirm the stability of the population. Fritz et al. (2008, pg. 16) found the Stellar sea lion population remained unchanged between 2004 (N=23,107) and 2007 (N=23,118) throughout much of its range from Cape St. Elias to Tanaga Island (145° to 178° W).

A substantial amount of research has been devoted to trying to determine the cause(s) of the western population of the Steller sea lion decline, whose number has dropped by more than 75 percent between

1976 and 1990 and another 40 percent from 1991 and 2000 (NOAA 2012, pg. 3). Currently, there is no consensus on a single causal factor, and it is likely that many factors could have contributed to the decline of this species (NMFS 2008, pg. III-1).

Different theories are presented to address the decline of this species which center on changes in ecosystem structure either as a result of top-down (direct), bottom-up (indirect) or a combination of the two forces (NMFS 2008, pg. III-1). Depending on the theory ascribed ecosystem modifications were triggered by whaling, fishing, predation or atmospheric and oceanographic changes and the emphasis of any one or in combination (NMFS 2008, pg. III-1). Many factors are implicated in the decline of the western population including food web interactions, predation, and exposure to contaminants, nutritional stress, and global climate change.

3.8 Species Summary

Of the species listed under the ESA only a subset were fully analyzed in this BE. In order to determine if a species warranted inclusion, EPA considered its likelihood of exposure to oil and gas exploration activities within the action area. Of the species under NOAA's purview the fin whale, humpback whale, Cook Inlet beluga whale and the Steller sea lion were analyzed fully. These species were included because they are present either year-round or seasonally in Cook Inlet. Of the species under USWFS's purview the Steller's eider, Kittlitz's murrelet and southwest DPS of the northern sea otter are included in the BE (Table 2).

There are number of ESA-listed species that have large home ranges that do not include the action area; these species are discussed fully in Section 5.5 of the ODCE (USEPA and Tetra Tech 2013). These species are the short-tailed albatross, sei whale, North Pacific right whale and the blue whale. In their letter of concurrence on the previous NPDES permit for Cook Inlet NOAA stated that "blue whales, North Pacific right whales, sperm whales, and sei whales are not expected to occur in the general permit area and therefore would not be exposed to the potential adverse effects of a large oil spill within Cook Inlet. Consequently, there would be no effect on these species in the unlikely event off an oil spill" (NOAA *in Litt*. 2006). Because of this feedback from NOAA, due to the extensive home ranges of the species, and the fact that their home ranges do not overlap with the action area EPA has determined that the effects of issuance of the GP are considered discountable for the blue whale, North Pacific right whale, sperm whale, and sei whale.

Although Pacific salmon stocks range throughout the North Pacific, EPA did not include the Snake River Chinook and sockeye stocks because according to NMFS "Snake River fall Chinook and Snake Rover spring/summer chinook [*sic*] salmon would occur in the project area rarely, if at all" (NOAA *in Litt*. 2006). Therefore, the Pacific Salmonids, short-tailed albatross, blue whales, northern right whales, sperm whales, and sei whales are not fully analyzed in this BE (Table 3).

TABLE 4. SPECIES AND THEIR DESIGNATED CRITICAL HABITAT CONSIDERED FOR ANALYSIS

Species	*Likelihood of Presence in the Action Area (Y/N)*	*Designated Critical Habitat in the Action Area*	*Analyzed in the Biological Evaluation*
Snake River Spring/Summer/Fall Chinook	No	No	No
Snake River Sockeye	No	No	No
Short-tailed Albatross	No	None Designated	No
Steller's Eider	**Yes**	No	**Yes**
Kittlitz's Murrelet	**Yes**	No	**Yes**
Blue Whale	No	No	No
Fin Whale	**Yes**	None Designated	**Yes**
Humpback Whale	**Yes**	None Designated	**Yes**
North Pacific Right Whale	No	None Designated	No
Sei Whale	No	None designated	No
Sperm Whale	No	None Designated	No
Northern Sea Otter	**Yes**	**Yes**	**Yes**
Cook Inlet Beluga Whale	**Yes**	**Yes**	**Yes**
Steller Sea Lion	**Yes**	No	**Yes**

4.0 Environmental Baseline

The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early ESA Section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process [50 CFR §402.02]. The environmental baseline should sustain the biological requirements, including habitat features and processes necessary to support the life stages of ESA-listed species within the action area. An environmental baseline that fails to meet the biological requirements of an ESA-listed species may result in a reduction in fitness and increase in the likelihood that the species may be adversely impacted by the action.

The purpose of characterizing the environmental baseline is to consider it along with interrelated, interdependent and cumulative effects to determine the overall effects of the action on the species. The environmental baseline in this BE focuses on effects of various activities identified in the recovery plans for the listed species that affect their survival and recovery in the action area.

During the last 20 years, the MMS (now BOEM) has consulted with the Services on previous lease sales for oil and gas exploration, development and production within the permit and surrounding areas (Table 5). None of the consultations to date have resulted in a jeopardy or adverse modification of critical habitat determination.

TABLE 5. PAST ENDANGERED SPECIES CONSULTATIONS WITH NOAA-NMFS ON OIL AND GAS ACTIVITIES IN COOK INLET

Consultation Date	***Species Covered***	***Action***	***Determination***
1980	Endangered Whales	Exploration Lease Sale 60	No Jeopardy
1984	northern right whales	Exploration Lease Sale 88	No Jeopardy
1993	Steller sea lions, and gray, humpback, right, fin, sea, sperm and blue whales and designated critical habitat.	Exploration Lease Sale 149	No Jeopardy/No Adverse Modification
2003	Steller sea lions, humpback whales, fin whales and designated critical habitat.	Exploration Lease Sales 191 and 199	No Jeopardy/No Adverse Modification
2012	Cook Inlet Beluga Whales and Steller sea lions and designated critical habitat.	3-D Seismic Surveys	No Jeopardy/No adverse Modification

The condition of the environmental baseline is an important influencing factor on the resiliency of animals to respond to new stressors within their range. If the condition of the environmental baseline is good and the biological requirements of the species are met, then species are likely to be more robust to additional stressors in its environment. The biological requirements of the species within the action area include the maintenance, or enhancement of habitat conditions (both physical and biological), prey availability and water quality to allow for the recovery and future conservation of the species.

The following sections describe the anthropogenic factors that affect the quality of the environmental baseline and as a result the status of the species in the action area; these factors include shipping activity and vessel movement, oil and gas development, ambient noise and noise pollution, entanglement in fishing gear, water quality degradation and subsistence harvest. The effects of the action are considered in light of the condition in the environmental baseline described below to evaluate the overall effect of the action on the species.

The following sections rely on the information presented in the *Final Environmental Impact Statement for the Cook Inlet Planning Area Oil and Gas Lease Sales 191 and 199* (MMS 2003) and the *Outer Continental Shelf Oil and Gas Leasing Program Final Programmatic EIS* (BOEM 2012) .

4.1 Action Area

The project area is the "footprint" of the proposed action and in this case it is the area where discharges are authorized under this proposed GP. The action area is defined as all areas to be affected directly and indirectly by the proposed action and not merely the immediate area involved in the action [50 CFR §402.2]. In order to delineate the action area it is necessary to determine the farthest extent of the direct, indirect and interrelated and interdependent effects of the action. The issuance of this proposed GP effectively authorizes discharges associated with the exploration of oil and gas within the federal waters of Cook Inlet. However, there are other interrelated and interdependent actions that likely have direct and indirect effects. Ordinarily, for a discharge permit the size of the action area is dictated by the distance the discharges travel from the point source. This distance is not always dictated by the regulatory mixing zone but in some cases the distance required for the chemicals in the effluent to reach background concentrations.

The discharges authorized under this proposed GP are not permitted to enter State waters; additionally prohibited areas described in Section 2.4 also limit the size of the action area. Language in the proposed GP stipulates that no discharges will occur in the boundaries, or within 4,000 m of a coastal marsh, river delta, or river mouth, or a State game refuge, State game sanctuary, Critical Habitat Area, or National Parks the project area [see Section 1.2.2 of the ODCE (EPA and Tetra Tech 2013)] (Figure 2).

According to BOEM (2012, Section 4.1.1.1, Table 2.11-1) there are a number of "impact-producing" factors associated with oil and gas exploration that are germane to the proposed action. Generally, the factors (hereafter referred to as stressors) associated with this action include:

1) Noise produced by drilling, vessels and aircraft;

2) Traffic which pertains primarily to movement of vessels to and from the exploration platform;

3) Drilling mud and debris (covered previously) discharged from the platform;

4) Lighting of the platform at night, and

5) Accidental spills of materials used in the day to day exploration operations.

Of these stressors presented above underwater sound (noise) generated by support vessels (boats and aircraft) and accidental spills could have the farthest reaching effects and therefore influence the size of the action area. Therefore, we discuss the potential for these stressors to increase the size of the Action area.

In-air and under water noise is produced during exploration and generated by drilling, vessels and aircraft (BOEM 2012, Section 4.1.1.1, Table 2.11-1). The range of underwater sound is difficult to predict which makes it difficult to predict how it may influence the size of the action area. The degree to which the noise attenuates in water is dependent upon spreading, absorption, and scattering loss and boundary effects from the surface and bottom of the ocean (BOEM 2012, pg. 3-70). Spreading loss has the greatest influence on the sound attenuation and where boundaries (ocean surface and bottom) do not interfere sound propagates in a spherical fashion dropping by 6 dB per doubling of distance from the source. When sound encounters a boundary layer it converts to a cylindrical configuration, which reduces the rate at which it drops to 3 dB per doubling of distance. Scattering and absorption losses also vary linearly with distance. The seafloor has a significant influence on absorption and scattering as do the presence of hard materials like rocks and soft materials like mud which result in scattering and absorption, respectively.

In order to determine if the action area should be expanded as a result of underwater noise it would be necessary to predict where the sound would be generated, including depth and proximity to boundaries, hard materials and soft substrates. At this time we have no knowledge of the future location of drilling other than the current prohibitions and the restriction on discharges within state waters already depicted in the action area. Consequently, it is not possible to predict whether the action area would be expanded as a result of underwater sound produced by the drilling or drill rigs.

Noise is also produced by vessel and aircraft traffic that functions as logistics support for the exploration operations. Marine and air logistical support for drilling operations in State waters primarily stages from Nikiski and Kenai/Nikiski municipal airport or a helipad operated by an oil field contractor, respectively (MMS 2003, pg. II-5). It's possible that these areas may also provide logistical support for operations in Federal waters, however it's more likely that staging will take place farther south (around Homer). So, impacts may occur from vessel activity but these impacts may not extend to the north. Nevertheless, EPA has conservatively extended the action area to the north to include the area between the current aquatic action area and Nikiski based on underwater sound generated by vessels and in-air sound generated by helicopters (Figure 4). This extended portion of the action area is hereafter referred to as the non-exploration action area.

EPA has extended the action area to the Forelands in order to insure that interrelated actions relating to the support of the drilling vessels are considered in the analysis. Specifically, the non-exploration action area applies to the indirect effects of the movement of boats and aircraft going to and from drilling vessels. The effects associated with these actions include noise disturbance from ships and aircraft and the potential for vessel strikes.

The information on oil spills available in the literature is for oil production rather than exploration. EPA acknowledges that the risk of accidental spills is inherent in oil exploration. However, the majority of information on the magnitude and frequency of oil spills is for production rather than exploration. According to EPA (2006 pg. 4-6), the number of spills for the offshore oil and gas production industry in Cook Inlet is approximately 2,700 small spills (less than 1,000 barrels) per billion barrels. Predicting the composition, size and movement of a spill emanating from an exploration well would be too uncertain to establish the size of the Action area.

4.2 Current Status of the Environment

Cook Inlet is part of the Gulf of Alaska marine ecosystem and the action area, as described in Section 5.1 includes only the lower portion of the Inlet. The configuration of action area for this permit is very similar to the area encompassed by Lease Sales 190 and 191 described in the EIS prepared by the MMS (2003, pg. III-9); much of the following description of the action area was presented in that document and will be cited accordingly. Where information on the current status is presented in the ODCE (EPA and Tetra Tech 2013) the reader is directed to the pertinent sections of that document.

4.2.1 Circulation and Tides

Please see Section 4.2 Oceanography in the ODCE (USEPA and Tetra Tech 2013) for a description of circulation and tides in LCI.

4.2.2 Water and Sediment Quality

Please see Section 4.2 Oceanography in the ODEC (USEPA and Tetra Tech 2013) for a description of water and sediment quality and transport.

The Cook Inlet Watershed is approximately 100,000 km^2 and is home to two-thirds of the population of Alaska (approximately 469,000). The average annual volume of water flowing from streams into Cook Inlet exceeds 70 billion m^3 which may be an underestimation because the discharge rates of some streams on the west side of Cook Inlet have not been measured (MMS 2003, pg. III-12).

Cook Inlet is a relatively large tidal estuary with a considerable tidal range. A large volume of water and naturally occurring inorganic and organic substances are transported into Cook Inlet by the streams and rivers and by currents from the Gulf of Alaska. Substances transported in Cook Inlet remain in suspension or dissolve in the water column and are dispersed by tidal currents and winds (MMS 2003, pg. III-32).

The tidal ranges in Cook Inlet are believed to be among the largest in the world (Archer and Hubbard 2003 cited in BOEM 2012, pg 4-50). The turbulence associated with the mainly tidal currents but also winds results in vertical mixing of the waters. Because tidal turbulence is the major mixing factor in Cook Inlet, rather that seasonally varying fresh water input, this flushing rate is relatively consistent from season to season. On the basis of standard salt balance calculations, 90 percent of waterborne contaminants would be flushed from the Inlet in 10 months (MMS 2003, pg. III-12).

4.2.2.1 Water Quality

According to EPA (2008, pg. 213) the waters of Southwest Alaska (including Cook Inlet) are considered good. Substances enter Cook Inlet waters and are diluted and dispersed by the currents associated with the tides, estuarine circulation, wind-driven waves and currents, and Coriolis force (MMS 2003, pg. III-12). The quantities of man-made substances routinely discharged into Cook Inlet generally are less then discharged by the streams and rivers (MMS 2003, pg. III-32).

During the summer and fall surface salinity ranges from 32 percent at the entrance to LCI to approximately 26 percent at the West Forelands (numerous authors cited in BOEM 2012, pg. 3-43). Dissolved oxygen levels are in the normal range from 7.2 to 11.0 ml/L and because of the strong tidal currents oxygen depletion is not a concern (BOEM 2012, pg. 3-43). The concentration of oxygen in the surface waters of Cook Inlet ranges from about 7.6 milliliters per liter (ml/L) in the northern part to 10 ml/L in the southwestern part (MMS 2003, pg. III-13). Data on conventional chemical parameters (and their concentration ranges) include phosphate [0.31-2.34 parts per billion (ppb)], nitrate (0-23.5 ppb), nitrite (0.02-0.52 ppb), ammonia (0.2-3.1 ppb) and silicate (9-90 ppb). In general, the concentration of phosphate increases toward the mouth of Cook Inlet, while the concentrations of nitrate and silicate decrease; the silicate concentration appears to be directly related to the suspended-sediment load (MMS 2003, pg. III-23).

4.2.2.2 Sediment Quality

According to MMS (2003, pg. III-13) approximately 80 to 90 percent of the 70 million tons of sediment deposited into LCI and Shelikof Strait originates from suspended sediments in river flows specifically from Knik, Matanuska and Susitna Rivers (Freeley and Massoth, 1982; Trefry, 2000 and Boehm, 2001 all cited in MMS (2003, pg. III-13)). Concentrations of suspended sediments in upper Cook Inlet are higher than those in the lower inlet. Suspended particulate matter that is derived from glacier-fed rivers flows into Cook Inlet. Tidal currents are major factors affecting sediment distribution and suspension. Near Anchorage, suspended sediments can exceed 2,000 mg/L; whereas near the Forelands, suspended sediment concentrations commonly range from 100 to 200 mg/L (MMS 2003); in the Shelikof Strait, suspended sediments range from 0.3 to 2 mg/L (Hampton et al. 1986 as cited in MMS 2003, pg. III-24).

The majority of hydrocarbons detected in the surface waters, suspended particulates, intertidal biota and bed load sediments in Cook Inlet are from natural sources (Shaw, 1981; Katz and Cline, 1981; Kaplan et al., 1980; Venkatesan and Kaplan, 1982; as cited in: MMS 2003, pg. III-14). Oil seeps are a source of hydrocarbons to Cook Inlet (MMS 2003, pg. III-14). In addition to the natural discharges there have been a number of accidental spills of a variety of substances, including crude oil and refined petroleum products. The low concentrations of hydrocarbons in Cook Inlet are similar to concentrations found in other unpolluted coastal areas (MMS 2003, pg. III-32). The amount of total organic carbon in sediments is low lessening the accumulation of hydrophobic contaminants (MMS 2003, pg. III-32). However, some of the persistent contaminants can accumulate in the food chain and exceed toxic thresholds, especially in apex predators; they can also accumulate in the seafloor sediments.

The CIRCAC is tasked with providing advice and recommendations on policy, permits and regulations to improve marine transportation and oil facility operations within Cook Inlet. CIRCAC has developed and maintained a comprehensive environmental monitoring program (EMP) within Cook Inlet, and effort that includes establishing baseline environmental conditions from which to assess changes resulting from activities of the oil industry. The EMP conducted from 1993 to 1997 included sample collection and toxicity testing components. Benthic, sediment and tissue samples were collected from a number of locations throughout Cook Inlet and toxicity testing was conducted to determine if PAHs or trace metals were present at levels that would result in toxicity (LEES 1999). During the five years of monitoring, sediment and/or tissues were collected from 87 different locations within eight general sites; these sites include Kamishak Bay, Kachemak Bay, the “Null Zone” and Cape Douglas in Shelikof Strait.

Results from the sediment sampling showed low levels of PAHs (40 to 50 times lower than conservative benchmarks developed by NOAA). The sources of PAHs were varied but the EMP was not able to attribute them to Cook Inlet oil and gas development activities. Neither total PAHs nor congeners were elevated in any of the locations within the action area. Trace metals were also not elevated at Cape Douglas. Lipophilic compounds were not elevated in surface waters in Shelikof Bay, and trace metals were not shown to be bioaccumulating in bivalves. There were no adverse effects at the individual or population (based on density) levels; sublethal effects were also not evident (LEES 1999, Table 4-1, pg. 52).

Dated sediment cores collected in the outer regions of Cook Inlet in 1997 and 1998 demonstrated that the concentration of hydrocarbons has not increased substantially since pre-oil exploration and gas production activities in Cook Inlet (BOEM 2001; as cited in BOEM 2012, pg. 3-44); these concentrations were reported to range from 120 to 490 ppb. Apparently, the highest concentrations were detected in the southeast corner of Cook Inlet and were assumed to be an artifact of eroded coal and oil sources in addition to seep oil transported by the coastal current entering Cook Inlet from the Gulf of Alaska (BOEM 2001; as cited in BOEM 12012, pg. 3-44).

4.2.3.3 Nonpoint sources

Many contaminants in Cook Inlet waters are derived from natural (or nonpoint) sources. Nonpoint sources of water pollution also are multiple, diffuse sources of pollution. The primary nonpoint sources of pollution are runoff from urban areas and communities, farms, and mining areas (MMS 2003, pg. III-14).

Stormwater runoff is often a significant source of non-point source pollution to receiving water bodies. Pollutants transport from this source includes both organic (pesticides, PAHs) and trace metals (copper and zinc). There are few population centers that could influence water quality in the action area (Figure 5).

The majority of the action area is unpopulated with population centers on the Kenai Peninsula. Homer is the only community classified as a city, population 5,085 (as of 2011). Therefore, the amount of non-point source pollution in south Cook Inlet is minimal. The major urban related point source is the City of Homer wastewater treatment plant which can discharge up to 1.4 million gallons of effluent during peak flows into Kachemak Bay.

4.2.3.4 Point Sources

Petroleum Industry

Section 2.2 of the ODCE (USEPA and Tetra Tech 2013) includes a discussion of oil exploration in State and federal waters. Currently, there are only two land-based gas facilities operating in the vicinity and no offshore operations within the action area (Figure 6).

Exploration Discharges

The activities associated with petroleum exploitation most likely to affect water quality down current in the action area include: 1) the permitted discharges from exploration-drilling units and production platforms, and 2) petrochemical plant operations. Petroleum production operations in upper Cook Inlet discharge a large volume of water and a variety of chemicals associated with petroleum exploration and production. From the 1960s to the end of 2001, approximately 1,030 million barrels of oil and 978 million barrels of water were produced mainly from four offshore oil fields in upper Cook Inlet. Peak production from these fields occurred in 1970 when about 70 million barrels of oil were produced. By the end of 1975, about 514 million barrels of oil and 61 million barrels of water had been produced—about 50 percent of the total amount of oil and six percent of the total amount of water produced from the offshore platforms through 2001 (MMS 2003, pg. III-17).

Produced water constitutes the largest source of naturally occurring and man-made substances discharged into the receiving waters. Produced water is part of the oil/gas/water mixture produced from the wells and contains a variety of dissolved substances from the geologic formations. These can include small quantities of naturally occurring radioactive materials, although concentrations from fresh water formations such as those that exist under Cook Inlet are usually low in these materials. Furthermore, chemicals are added to the fluids that are part of various activities including water flooding; well work over, completion, and treatment; and the oil/water separation process. These chemicals might include flocculants, oxygen scavengers, biocides, cleansers, and scale and corrosion inhibitors. During the 1987-1988 Cook Inlet Discharge Monitoring Study of production platforms, the volumes of chemicals added during the various operations ranged from less than 4 to 410 liters per day per platform. The discharge of produced water is of concern because of the types and amounts of naturally occurring substances they might carry and man-made substances that might be added (MMS 2003, pg. III-17). The discharge of produced water is not authorized under this proposed GP.

Drilling Fluids and Cuttings

Between 1962 and 1994, about 546 wells were drilled primarily in upper Cook Inlet (MMS 2003, pg. III-19). One Continental Offshore Stratigraphic Test (COST) well and 11 exploration wells were drilled in federal waters between 1962 and 1970 and 75 explorations and 459 development and service wells were installed in State waters. Drilling fluids are used in this process and cuttings are generated.

The amount of barite (barium sulfate-$BaSO_4$) in the drilling fluids is estimated to be approximately 63 percent. Barium makes up about 59 percent of barite or about 37 percent of the drilling fluid. The amount of barium that might have been discharged into Cook Inlet between 1962 and 1993 is estimated to be about 46,200 tons. For a single well discharging 330 tons of drilling fluids, the amount of barium discharged is estimated to be about 122 tons. EPA's limits the amount of mercury and cadmium in the barite to 1 mg/kg mercury and 3 mg/kg cadmium (dry weight, dw); these limits are assumed to be the concentrations of mercury and cadmium in the discharged drilling fluids. The amount of mercury and cadmium discharged per well (based on 330 tons of drilling fluids per well) is estimated to be 0.12 kg (0.26 lb) and 0.36 kg (0.8 lb), respectively.

Other Discharges

Seawater is the principal component of most of the discharges and in some cases it is the only constituent. Other discharges contain a wide range of concentrations of the various additives. The rate of adding compounds to the discharge ranges from less than four to hundreds of liters per month, while the discharge rates of the various effluents might range from zero (for intermittent discharges) to tens of cubic meters per day, or more.

Oil Spills

Oil spills have occurred in Cook Inlet and these spills and the risk of future spills are an issue of major concern. The oil spill records are not complete for the entire production period of Cook Inlet (1957 to present); however, this section summarizes the available information about the nature of oil spills from production facilities and pipelines in Cook Inlet.

Three pipeline ruptures in 1966, 1967, and 1968 each released approximately 1,400 barrels of oil to Cook Inlet (MMS 2003, V-15). Crude- and refined-oil spills from tankers, motor vessels, or other known sources have also taken place in Cook Inlet. The oil spill records are not complete for the entire period of Cook Inlet recorded marine transportation spills (1949 to present); however, the available information is summarized below in Table 6.

In addition to the tanker spills, there are at least two documented spills from outside the Cook Inlet that have drifted into Cook Inlet. The first spill was from an unidentified source documented in 1970. The suspected source of the spill was from some tank vessel dumping ballast and slop at sea, which used to be a common practice. No oil-spill volume was provided in the spill report. On the basis of the estimated number of dead birds and the length of coastline oiled, it was estimated that this spill was greater than or equal to 1,000 barrels. This spill affected LCI, including the Barren Islands, Kodiak Island, and Shelikof Strait. The second documented tanker spill is the *Exxon Valdez* spill, when one to two percent of the material spilled entered into LCI reaching as far north as Anchor Point (MMS 2003, pg. III-21).

TABLE 6. COOK INLET RECORDED MARINE TRANSPORTATION SPILLS

Year	***Name***	***Location***	***Type***	***Barrels***
1996	*Homer Harbor Waste Oil*	Homer	Used oil –all types	100
1997	*F/V Blue Fox*	South Cook Inlet	Diesel	200
1998	*Icicle Seafoods*	Homer	Ammonia	8,270
1998	*F/V K-Bay Spill*	Homer	Gasoline	100
1998	*F/V Sputkin*	Central Cook	Diesel	100
1999	*T/V Chesapeake Trader*	Central Cook	Crude	420
1999	*F/V Irish*	Homer	Crude	300
2000	*Nikiski Tesoro*	West Central	Gasoline	200
2000	*Kenai Diesel*	Kenai	Diesel	100
2004	*F/V Susitna* Diesel	Homer	Diesel	150
2004	*F/T Aurous* Ammonia	Homer	Ammonia	1,082
2004	Cook Inlet Oil Stringers	Central Cook	Crude	100
2008	*K-Sea POL* # 1 Jet Fuel 3.30.08	Cook Inlet	Jet fuel	275
2012	*K-Sea* Transportation barge day tank release	South Cook Inlet	Diesel	600

4.3 Characterization of Threats in the Action Area

When species are listed under the ESA the listing agency is directed through regulation to develop and implement a recovery plan for the species. These recovery plans often include a description of the threats (historical and current) that have led to the condition of the species. EPA has reviewed these recovery plans, and profiles for species that as yet have no recovery plan to obtain the list of threats. In the following sections we discuss these threats as they relate to the condition of the baseline and ultimately influence the status of the species in the action area. Some of the threats are indirect, that is the stressor is a threat to habitat quality (e.g. prey and water quality).

These threats include shipping and vessel movement, oil and gas development, coastal development, water quality, subsistence harvest and ambient and underwater sound.

4.3.1 Shipping and Vessel Movement

Open water species such as the Cook Inlet Beluga Whale, humpback and fin whales and Steller sea lions can be harmed or killed by a strike from a moving vessel. The likelihood of a ship strike depends in part on the amount of vessel traffic in the water body.

4.3.1.1 Vessel Composition and Volume

Cook Inlet has an active port and marina facilities but moderate to low amounts of vessel traffic. Between January 2005 and July 2006 704 deep draft vessels called at ports in Cook Inlet (Cape International Inc. and Nuca Research and Planning Group 2006, pg. 3). These were not 704 different vessels, but 12 vessels operated by six companies which accounted for 80 percent this traffic; approximately half were container ships, followed by vessels carrying liquid gas and petroleum (29 percent) and ferries (17 percent). A substantial number of these ships were large, 486 ships of 300 gross tons or more which equate to eight to ten ships per week. The ADF&G keeps the records of fishing vessels in the waters of Cook Inlet. In 2005 there were 559 vessels registered for the Inlet salmon and groundfish fishery ranging between 20 and 100 ft in length (Cape International Inc. and Nuca Research and Planning Group 2006, pg. 9).

As of 2006 fuel barge traffic in Cook Inlet was considered light to moderate compared to other water bodies of like size and area. Approximately, six million barrels of fuel oil was transported into and through Cook Inlet on 200 tug/barge voyages (Cape International Inc. and Nuca Research and Planning Group 2006, pg 18).

In 2010 there were 500 vessels making call in Cook Inlet. The majority (65 percent) of these were evenly distributed between ferries, container and cargo ships. The number of operating days was greatest for vehicle ferries (225 days) followed by cargo ships (roll on/roll off, 218 days), container ships (212 days) and crude oil carriers (205 days) (Cape International Inc. 2011, pg. 6).

The Alaska Marine Highway takes ferries into the Southeast section of Cook Inlet at Homer and Seldovia. From March to September 2013 all vessels will make between nine and 20 calls per month to these locations. This is consistent with past volumes when two of the ferries (Tustumena or Kennicott) made between 14 to 19 calls per month between Homer and Seldovia from March through December (Cape International Inc. and Nuca Research and Planning Group 2006, pg. 14).

Vessel traffic in Cook Inlet declined from 2005 to 2010 from 704 to 500 vessels per year with the exception of Alaska Marine Highway ferry traffic which has remained constant. The 10-year forecast for vessel traffic is based on a number of factors, potentially the most influential being the declining Cook Inlet oil and gas production, the Alaska gas pipeline and development of Port MacKenzie and Ladd's Landing (Cape International Inc. 2011, pg. 10). The projected growth of vessel traffic is expect to be from 1.5 percent to 2.5 percent unless the Port MacKenzie and Ladd's Landing development projects are developed, then vessel traffic could increase by 40 percent (200 ships per year) (Cape International Inc. 2011, pg. 13).

Vessel traffic in Cook Inlet is considered moderate to low with a handful of companies operating in the water body. Vessel traffic declined during the last decade and will be increasing only slightly unless major development projects are completed.

4.3.1.2 Ship strikes

Ship strikes occur worldwide and of the reported cases whales are hit by navy vessels, cargo/container ships or freighters, whale watching vessels, cruise ships, ferries, Coast Guard ships and tankers, in that order (Jensen and Silber 2004, pg. 4). According to Cape International Inc., and Nuka Research (2006) with the exception of military and whales watching vessels all other classes make call in Cook Inlet.

Considering the information on the number of vessels making call in Cook Inlet it is apparent that the potential for ship strikes could be significant. In the case of beluga whales, strikes are more likely from smaller recreational or fishing vessels traveling at higher speeds and more erratically than the larger slower vessels (e.g. cargo ships) (NMFS 2012, pg. 55). Records do not report confirmed deaths of CIBW, but there was one case reported in 2007 of a beluga that had washed ashore with a wound suggestive of a ship strike. NMFS does not believe that larger vessels pose a significant risk to Cook Inlet beluga whales but they have observations of beluga's with propeller scars indicating interactions with smaller boats (Burek 1999; McGuire et al. 2009, 2011 cited in NMFS 2012, pg. 55).

The greatest numbers of collisions reported by Jensen and Siber (2004, pg. 8) are with fin (finback) whales. There is no baseline information on ship strikes with Steller sea lions and NMFS (2012) did not discuss the impact of this stressor on this species in their biological opinion.

Direct ship strikes are a source of mortality in humpback whales from the eastern North Pacific stock in California, Oregon, and Washington where there was an average of 0.6 whales killed per year (Barlow et al. 1997 cited in Perry et al. 1999, pg. 35). Jensen and Silber (2004) compiled the data NOAA fisheries collected on ship strikes throughout the world, none of the reported strikes occurred in Cook Inlet (Table 7). Humpback whales are the second (only to finback whales) most often reported cetaceans to be struck by vessels. The high reporting rate may be because humpback whales occur closer to shore and so carcasses are more likely to be observed (Jensen and Silber 2004, pg. 2).

TABLE 7. CONFIRMED AND POSSIBLE SHIP STRIKES TO LARGE WHALES (FROM JENSEN AND SILBER 2004)

Date	***Species***	***Location***	***Result***
07/16/2001	Humpback	Glacier Bay	Mortality
06/19/2001	Humpback	Dixon Entrance	Not reported
11/02/1999	Humpback	Metlakatla, AK	No sign of injury
07/28/1999	Humpback	Stephens Passage	Mortality
09/24/1998	Humpback	North Pass, outside of Juneau	Unknown
08/11/1998	Humpback	North Pass, outside of Juneau	No sign of injury
10/12/1997	Sperm	Prince William Sound	No sign of injury
07/12/1997	Humpback	NW Shelter Is, outside Juneau	Injury
05/20/1997	Gray	¼ mi S. of Kah Shakes Cove	Mortality

Major threats to humpback whales include entanglements or other injuries caused by fishing gear and vessel collisions. Large ships, recreational vessels, and tugboats with barges are potential collision hazards for humpback whales in Alaska (NMFS 1991, pg. 27). Between 1997 and 2001 there were six ship strikes and eight entanglements involving humpback whales in Southeast Alaska based on stranding reports (Angliss and Lodge 2002, pg. 156). In 2001, NMFS issued regulations to prohibit most approaches to humpback whales in Alaska within 100 yards to minimize the impacts of whale watching (66 FR 29501; May 31, 2001).

According to the information available on the frequency of ship strikes with cetaceans and pinnipeds, there is one report of a beluga whale strike and no humpback or fin whales or Steller sea lion ship strikes in Cook Inlet. Beluga whales are more vulnerable to strikes by smaller, fast moving vessels as evidence by scarring of individuals in Cook Inlet. Any increase in smaller fishing and recreational boats could pose a threat to Cook Inlet Beluga whales. Humpback and fin whales are frequent victims of ship strikes but none have been reported for Cook Inlet and there are no reports of vessels striking Steller sea lion, likely because these animals are very deft at avoiding ships due to their smaller size (relative to whales) and maneuverability.

EPA is not aware of an increase in small vessel traffic in Cook Inlet. Ship traffic is projected to increase slightly unless major development projects are completed. The current baseline conditions and future projections do not lead us to anticipate an increase in ship strikes.

4.3.2 Oil and Gas Development

Oil and gas development has been identified as a threat to four of the ESA-listed species under consultation the Steller's eider, beluga whale, northern sea otter and Steller sea lion.

There is a long history of oil and gas development in Cook Inlet as this region overlies significant reserves of oil and gas. Oil and gas development has been in operation since the 1950's in upper Cook Inlet and the Kenai Peninsula, as a result infrastructure is over 40 years old and in need of repair. During the height of production there were 16 offshore production and three onshore treatment facilities in upper Cook Inlet. These facilities maintained 230 miles of undersea pipelines. There are 16 platforms in upper Cook Inlet with 12 in active operation today (NMFS 2012, pg. 43-44).

No platforms are in place in the lower Inlet and no lease sales are scheduled until 2016. Currently, there are 391 active oil and gas leases, totaling approximately 986,153 acres of State leased land with approximately half (449,884 acres) offshore with the remaining inshore. In 2012 the State of Alaska provided a financial incentive of $20 to $25 million in tax credits for the first three wells drilled from jack-up rigs in Cook Inlet. As a result two new companies are in operation and in the process of evaluating well locations and active drilling (NMFS 2012, pg. 43-44).

4.3.2.1 Status of Oil and Gas Production to Date

From the 1960s to the end of 2001, approximately 1,030 million barrels of oil and 978 million barrels of water were produced mainly from four offshore oil fields in upper Cook Inlet. Peak production from these fields occurred in 1970 when about 70 million barrels of oil were produced. By the end of 1975, about 514 million barrels of oil and 61 million barrels of water had been produced; about 50 percent of the total amount of oil and 6 percent of the total amount of water produced from the offshore platforms through 2001 (MMS 200, pg. V-20). In 2000, the oil-production platforms produced about 9 million barrels of oil and 47 million barrels of produced water (MMS 2003 cited in Tetra Tech 2006, pg. 4-3).

In 2002 there were 15 oil-production platforms and 1 gas-production platform operating in upper Cook Inlet. Additionally, there were three production-treatment facilities onshore; produced water from 10 of the oil-production platforms is treated at these facilities (Tetra Tech 2006, pg. 4-3).

NMFS summarizes the history of oil and gas development In Cook Inlet in their 2012 Biological Opinion (NMFS 2012, pg. 43). Cook Inlet has a long history of oil exploration and production beginning in the mid part of the last century. The majority of platforms were in place by 1967 and at the peak of infrastructure development there were 16 offshore production facilities in place supported by 230 miles of undersea pipeline. Oil production in Cook Inlet declined in the early 1990's and some of these 16 facilities were left dormant. Currently, the offshore facilities support over 200 wells with 16 platforms in upper Cook Inlet, of which 12 are currently active. There are 391 active oil and gas leases on State leased lands (ADNR 2011 as cited in NMFS 2012, pg. 44). There are no platforms in LCI and no new permits have been issued to construct new permanent platforms. As stated previously (Section 2.1) one special lease sale is scheduled for Cook Inlet and exploration that will occur as a result of that sale will take place in federal waters under this proposed GP.

Oil production has declined in Cook Inlet over the last approximately 30 years. At present all of the active production is located in upper Cook Inlet and no activity is taking place in federal waters of the lower Inlet. Upon completion of the lease sale slated for 2016 exploration will very likely commence in the lower inlet.

4.3.2.2 Oil Spills and other Releases in the Action Area

Not unlike other areas with an active petroleum industry oil spills have occurred in Cook Inlet. However, only a subset of these releases occurred in the action area (Table 8). These releases have been the result of pipeline ruptures and oil spills from vessels. In addition to the spills identified in Table 8 there were two significant spills that affected LCI as previously discussed (MMS 2003, pg. III-21).

TABLE 8. PETROLEUM RELEASES OVER TIME IN COOK INLET

Year	***Month***	***Material***	***Location***	***Amount (gal)***
1996	August	Used oil	Central Kenai	100
1998	July	Gasoline	Central Kenai	100
1998	September	Diesel	Cook Inlet	100
1999	February	Crude	Cook Inlet	420
1999	July	Diesel	Central Kenai	300
2004	February	Diesel	Central Kenai	150
2004	October	Crude	Cook Inlet	100
2012	June	Diesel	Central Kenai	100
Total				**1,370**

The oil spills reported by NMFS (2012, pg. 50) that originated from oil platforms and gas well blowouts, were not located in the action area. Only three of the spills occurred during exploration and none exceeded three gallons.

Oil and material spills have occurred in LCI, however these spills (Exxon Valdez and the ballast water release notwithstanding outside of Cook Inlet), were not in excess of 100 gallons (Table 8). Marine transportation spills have yielded larger volumes of material particularly for ammonia (Table 6). Small spills with volumes equal to or less than 3 gallons were associated with exploration.

4.3.3 Coastal Development

Cook Inlet is central to the most populated and industrialized area in south central Alaska. Numerous cities, villages, seaports, airports, treatment plants, oil and gas platforms, refineries, railroad and highways are either within or in close proximity to the Inlet. With the exception of Homer most of the development is to the north of the action area. There are seafood processing facilities and miscellaneous facility discharges along the shoreline. However, the action area for this permit is within federal waters which are three miles from shore.

The projects considered for development, facilities at Port MacKenzie and Ladd's Landing are located within the upper Cook Inlet. It is unlikely that there would be additional development in LCI if these projects were to come to fruition.

4.3.4 Water Quality

The primary sources of anthropogenic contaminants in Cook Inlet consist of discharges from municipalities, seafood processors and the petroleum industry, storm water runoff from urban, agricultural and mining areas and spills or discharges of crude or refined petroleum (BOEM 2012, pg. 3-43; MMS 2003, pg. 3-13). According to EPA's EnviroMapper [7] there are 42 facilities (22 RCRA and 20 "water") that discharge in the vicinity of the action area. These facilities include municipal wastewater, seafood processing, petroleum refineries, department of transportation and other miscellaneous facilities. Additionally, as presented in Table 6 14 transportation-related spills have occurred in Cook Inlet over the past 16 years. In addition to anthropogenic sources which carry associated contaminants, there are naturally occurring substances which enter Cook Inlet via river and stream systems and airborne pathways.

Municipal wastewater is the source of a significant number of contaminants including organics, metals, pharmaceutical and personal care products, nutrients, bacteria and viruses. Half of the 10 communities that discharge wastewater into Cook Inlet only treat the waste to primary levels which does a poor job at removing most chemicals. The Homer wastewater treatment facility which is within the vicinity of the action area treats the waste to secondary levels which is a substantial improvement over primary treatment.

Stormwater is a significant contributor to degraded water quality in urban areas. Metals, organic pollutants and petroleum products are transported to aquatic environments via stormwater. The action area is relatively free of large urban areas and therefore stormwater is not a substantial concern for water quality.

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[7] http://www.epa.gov/emefdata/em4ef.html?ve=6,60.83300018310547,-151.63299560546875&pText=Cook Inlet, AK accessed by A. LaTier on 11/28/12

Ballast water discharges can consist of pollutants and nonnative species and this material is considered a significant threat to water bodies worldwide. According to NOAA (2012, pg. 49) and the National Ballast Information Clearinghouse greater than five million metric tons of ballast water was released in Cook Inlet, from Homer to Anchorage over a 14 year period (1999 to 2003).

Hydrocarbons in Cook Inlet originate from anthropogenic sources as well as natural sources and seeps from the sea bed. The MMS (2003, pg. III-24) reported the total hydrocarbon content of LCI water ranged from 0.2 to 1.5 µl/L and the analysis indicated that the hydrocarbons were biologically rather than anthropogenically produced. Activities associated with oil exploration and production (not spills) also affects water quality. Comparison of pollutant concentrations from exploration drilling and production platforms with federal and state water quality criteria did not result in predicted exceedances when evaluated by EPA(BOEM 2012, pg. 3-43).

However, there are fewer anthropogenic sources in the vicinity of the action area other than in upper Cook Inlet which may be the reason that the water quality in LCI is generally considered good. Cook Inlet is a large tidal estuary with a significant tidal range (8.5 m in the south to 11.0 m at Anchorage) and substantial turbulence due to tidal currents and wind which enhance vertical mixing (EPA and Tech 2006, pg. 4-2). There is little variability in the flushing rate due to this tidal turbulence and according to MMS (Kinney, Button and Schell 2003, pg. III-12) 90 percent of waterborne contaminants would be flushed from the Inlet in 10 months. It should be noted that contaminant loading and tidal flushing relate to water column contaminants only, those contaminants that are sequestered in sediments or build up in the food chain will remain in the system for a longer period of time.

Sediment sampling has been conducted over the years to measure for the buildup of hydrocarbons and other persistent chemicals. The higher concentrations of PAHs were found in the southeast corner of Cook Inlet likely as a result of eroded coal and oil sources and seep oil from the eastern Gulf of Alaska. Representative data show that the concentrations of total PAHs ranged from less than 120 to 490 ppb in the outer portion of Cook Inlet (BOEM et al. 2001a cited in BOEM 2012, pg. 3-44) and less than 10 to 840 ppb in Cook Inlet with the greatest number of samples less that 150 ppb (Saupe et al 2005 cited in BOEM 2012, pg. 3-44). Additionally, most metals are below effect levels (as defined by ADEC) with the exception of nickel and chromium which exceeded in a few sampling locations in Cook Inlet.

BOEM (2012, pg. 3-44) summarize by saying that “hydrocarbons are found throughout the waters of Cook Inlet in generally low concentrations. Natural oil seeps occur on the west side of the Cook Inlet, which release hydrocarbons from biogenic sources (Saupe et al. 2005). Concentrations generally are similar to those found in other unpolluted coastal waters”.

4.3.5 Subsistence Harvest

Subsistence harvest of Steller sea lions, Cook Inlet beluga whale, northern sea otters and Steller’s eiders is ongoing or no longer allowed due to decreasing populations. Information specific to the subsistence harvest of these species in the action area was unavailable; therefore, what is known about subsistence harvest of these species in general is described below.

In the past approximately 150 to 300 Steller sea lions were taken annually. At present, NOAA states that "new data available since the recovery plan continues to indicate that the subsistence hunting does not pose a threat to this population and this it is not likely to pose a threat in the foreseeable future" (NMFS 2012, pg. 44)

NMFS believes that subsistence harvest of Cook Inlet beluga whale that increased significantly between 1994 and 1998 can account for the estimated stocks decline during that time period (NMFS 2012, pg. 52). Subsistence harvest of this species stopped in 2000 due to a moratorium that required a cooperative agreement between NMFS and the Alaska Native organizations for an acceptable harvest level. Since 2005 only five beluga whales have been harvested from the Cook Inlet stock (NMFS 2012, pg. 52).

The majority of subsistence harvest of the SW DPS of the northern sea otter occurs around Kodiak. According to USFWS (USFWS 2010, pg. 3-29) " With the exception of 42 otters taken from the Chignik area, virtually all of the 1,775 animals taken from this unit during 1989 -2008 were harvested in the Kodiak archipelago. As there is no permanent human habitation along the Alaska Peninsula east of Chignik, or in Kamishak Bay, it is not surprising that the majority of the subsistence harvest from this management unit occurs around Kodiak" (USFWS 2010, pg. 3-30).

4.3.6 Ambient Noise, Underwater and Noise Pollution

Ambient noise includes both natural and anthropogenic sound. Natural underwater sound is generated by wind and wave action, movement of ice and biological activity. Currents and tidal fluctuations contribute to underwater sound are particularly active in Cook Inlet.

The chief sources of anthropogenic sound in greater Cook Inlet include aircraft over flights, vessel traffic, oil and gas activity along with underwater construction of pipelines docks and piers. There is very likely less anthropogenic noise in the action area as compared to other areas within Cook Inlet (BOEM 2012, pg. 3-84). The lower Inlet has a fewer people, less construction, and no active oil production facilities. Therefore, the following sections will present anthropogenic noise generated by aircraft and vessels. The natural (biological) sources of noise will not be discussed as these are not affecting the environmental baseline nor considered threats to listed species.

Vessels entering Cook Inlet via the Gulf of Alaska include all manner of tankers, container ships, tugs and ferries. Additionally, fishing boats routinely travel through the action area. The sound levels generated by these vessels are presented in Table 9.

TABLE 9. UNDERWATER SOUND GENERATED BY VARIOUS VESSELS AND OPERATIONS

Source	*Received Level dB re 1 µPa-m*	*Distance (meters)*	*Frequency Hz*
Transportation			
Cargo Freight	126	100-400	Generally < 1
Cargo Bulk Carrier[a]	134	>200	NR
Tug[b]	149	100	NR
Small Boat[c]	138	13	NR
Small Rubber Boat	142	8.5	NR
Aircraft (fixed wing and helicopters)	156-175	NR	45-7,075
Small Vessels (boats and ships)	145-170	NR	37-6,300
Ice Breakers	171-191	NR	10-1,000
Hovercraft and vehicles on ice	130	NR	224-7,070
Dredging and Construction			
Dredging	150-180	NR	10-1,000
Pile Driving	228	NR	Peak 100-500
Exploration Drilling			
Drilling from bottom-founded platforms	119-127	NR	5 – 1,200
Drilling from Vessels	154-191	NR	10-10,000
Drillship (Discoverer)[d]	177 to 185	NR	NR
Drillship (Explorer I)[e]	122 to 125	0.17 km (0.1 mi)	20 to 1,000
Drillship (Explorer II)[f]	134	0.2 km (1.2 mi)	600
Drillship (Kulluk)[g]	143	0.98 km (0.61 mi)	NR
[a]: with 2 tug boats [b]: pushing gravel Barge [c]: Boston whaler [d, e, f]: USFWS 2012 NR: Not reported From: BOEM 2012 Table 3.6.1-1 unless otherwise cited			

5.0 EFFECTS OF THE ACTION

The federal action under consultation is the reissuance of the NPDES general permit for oil and gas exploration located within the federal waters of LCI, Alaska. There are no direct effects associated with this action (or decision) however, the decision of approving the permit allows for the exploration to take place. Therefore, the activities associated with this approval may have direct, indirect interrelated and/or interdependent effects to listed species; those activities and effects are considered in the following sections.

5.1 APPROACH TO THE ANALYSIS

The EPA addressed the direct and indirect effects of reissuing the proposed GP on ESA-Listed and candidate species present in the Action area. We used an exposure-response approach to the analysis. The primary assumption was that for those species that are exposed to the permitted discharges, it is to conditions that may exist if the NPDES permit requirements are met. Potential effects arising from violations of the permit conditions were not evaluated.

In light of this qualification we evaluated the significance of potential effects in the context of two considerations: 1) whether or not the species may be exposed to activity-related stressors (Exposure Analysis), and 2) if exposed, describe the extent (in terms of frequency, magnitude and duration) of the potential direct and indirect effects (Response Analysis).

Stressors are defined as any physical, chemical or biological element (e.g. chemical discharge) or phenomenon (e.g. attraction to a lighted object) and any interrelated and interdependent actions resulting directly or indirectly from the action of reissuing the proposed GP.

The initial step in the analysis was to identify the stressors associated with the proposed action within the action area. Identification of the stressors also serves to define the total extent of the action area and the area within which the direct, indirect and cumulative effects are analyzed. Because the action area includes the indirect effects of interdependent and interrelated actions it can be larger than the footprint of the proposed action (federal waters).

We provided the list of species expected to occur in the action area in Section 3 and through the stressor identification and exposure analysis we refined that list. For this particular action it is not possible to say precisely where the exploration will take place, only that it will occur in the federal waters of LCI and outside of the buffers established for sensitive species and habitats as stipulated in Sections 2.4.1 of this document and 1.2.2 in the ODCE (USEPA and Tetra Tech 2013).

EPA used the best scientific and commercial data available to characterize potential exposure and predict the response of the species should it encounter the stressor. The duration of exposure and the magnitude of stressor determine the level of response which culminated in EPA's determination of the effect of the proposed action.

These following sections present: 1) the identification of stressors, 2) species exposure to stressors, and 3) species response to the stressors.

5.2 Stressor Identification

The following sections discuss the stressors generated by oil and gas exploration activities (i.e. drilling exploration and delineation wells) within the action area. This BE does not address seismic surveys, development of permanent oil/gas wells, production/extraction, or abandonment of permanent wells/facilities, as these actions would be authorized through a separate permitting process and would therefore undergo a separate assessment.

The permit covers specific discharges discussed in Section 2.0 of this BE and Section 3.0 of the ODCE (USEPA and Tetra Tech 2013). The potential direct effects of the action include exposure of ESA-listed and candidate species to these discharges. Potential indirect effects include impacts to the marine food web, primary constituent elements of designated critical habitat, general habitat impacts and platform lighting.

The following sections also include a discussion of the stressors generated by the interrelated and interdependent actions. The interrelated actions involve the use of vessels and aircraft in the routine operations of the facilities. The stressors generated by the use of these operations and craft include noise disturbance (in-air and underwater sound), collisions and spills.

5.2.1 Direct Discharges

Sections 3.0 and 6.1 in the ODCE (USEPA and Tetra Tech 2013) are incorporated into this document by reference. The following sections include a discussion of the composition and quantity of all authorized discharges in addition to the transport and fate of drilling fluids and cuttings in Cook Inlet.

There are a number of discharges authorized under this general permit and their effluent limitations are presented in Table 2 of the draft general permit[8]. Additionally, there are monitoring requirements for these discharges that vary in frequency and duration. Effluent limitations are designed to avoid and minimize toxicity of the specific discharges and are based on discharge amounts, minimum toxicity levels measured in samples collected at the end of the well and whole effluent toxicity test results. In order to ensure that discharges comply with both State Water Quality Standards and Ocean Discharge Criteria the proposed GP retains whole effluent toxicity triggers.

Because of the hydrodynamics in LCI which influence the rate of dilution of the discharges and the low likelihood that species will remain in close proximity to the drilling vessel, toxicity associated with direct exposure of ESA-listed and candidate species is a minor concern. Apparently, discharges less than 10,000 gallons per day (gpd) will be very dilute and are not likely to exhibit toxic effects at the edge of the 100 m mixing zone, therefore toxicity triggers were not proposed for these discharges. Instead we focus our analysis on the potential for metals in drilling fluids/muds to bioaccumulate.

The CORMIX model was used to conduct dispersion modeling to analyze and develop the general permit's water quality-based effluent limits and trigger levels for whole effluent toxicity. These materials are discharged at the highest volumes and contain metals that have a propensity to bioaccumulate.

5.2.1.6 Permitted Discharges

General operations on the drilling vessels will result in authorized discharges to the environment. The primary concern related to these discharges is the release of oil and grease. However, oil and grease will be gravity-separated from the runoff in a sump prior to discharge and then sent to an off-site facility for treatment. Sanitary waste would be treated with a marine sanitation devise prior to discharge, in order to meet Coast Guard requirements. Biocides could be added to drilling fluids, ballast water, fire control water and /or non-contact cooling water to control the growth of algae. These compounds are regulated under the federal Insecticide, Fungicide, and Rodenticide Act. These discharges would likely occur at lower volumes than the drilling fluids described above and are expected to dissipate within the extent of the mixing zone (i.e., 100 m radius around the discharge; ODCE Section 6.6.2.4 (USEPA and Tetra Tech 2013)). These discharges may have some short-term adverse effects to the pelagic and

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[8] http://www.epa.gov/region10/pdf/permits/npdes/ak/cook_inlet_gp/draft_gp_akg285100.pdf

benthic invertebrates/plankton communities found within the mixing zone but are not anticipated to have wide-ranging or long lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the environment.

The discharges with the majority of pollutants are the deck drainage, sanitary and domestic waste, muds cuttings and cement, and chemically treated sea water discharges.

Deck Drainage

Deck drainage refers to any wastewater generated from platform washing, deck washing, spillage, rainwater, and runoff from curbs, gutters, and drains, including drip pans and wash areas. This type of drainage could include pollutants such as detergents used in platform and equipment washing, oil, grease, and drilling fluids spilled during normal operations.

When water from rainfall or equipment cleaning comes in contact with oil-coated surfaces, the water becomes contaminated and must be treated and disposed. Oil and grease are the primary pollutants identified in the deck drainage waste stream (EPA 1993, pg. VI-9). In addition to oil, various other chemicals used in drilling operations may be present in deck drainage. These chemicals may include drilling fluids, ethylene glycol, lubricants, fuels, biocides, surfactants, detergents, corrosion inhibitors, cleaners, solvents, paint cleaners, bleach, dispersants, coagulants, and any other chemical used in the daily operations of the facility (Dalton et al 1985 cited in USEPA and Tetra Tech 2013, pg. 19).

Untreated deck drainage can contain oil and grease in quantities ranging from 12 to 1,310 mg/L. However, the proposed Cook Inlet Exploration general permits do not allow the discharge of deck drainage unless it complies with the effluent limitations specified in the permits. Discharge of oil and grease in prohibited.

The permit requires that deck drainage contaminated with oil and grease be processed through an oil water separator and prohibits the discharge of free oil. Oil and water are gravity-separated in a sump and skim pile system, the oil is sent off-site for disposal and clean water is discharged.

Sanitary and Domestic Waste

While some platforms discharge sanitary and domestic wastes separately, many combine these waste streams prior to discharge. Therefore, this section will discuss sanitary waste, domestic waste and the combined waste. Sanitary waste is human body waste discharged from toilets and urinals and treated with a marine sanitation device (MSD). The discharge consists of secondary treated chlorinated effluent. Domestic waste (gray water) refers to materials discharged from sinks, showers, laundries, safety showers, eyewash stations, and galleys. Gray water can include kitchen solids, detergents, cleansers, oil and grease. Domestic waste includes solid materials such as paper and cardboard which must be disposed of properly. Domestic waste is incinerated, reused to make drilling fluid, or discharged directly into receiving waters.

The volume of sanitary wastes varies widely with duration, occupancy, platform characteristics and operational situation. Pollutants of concern in sanitary waste include biochemical oxygen demand, total suspended solids (TSS), fecal coliform bacteria, and residual chlorine.

The proposed Cook Inlet Exploration general permits allow the discharge of sanitary and domestic wastes provided effluent limitations are met. Sanitary wastewater must be treated with an approved MSD prior to discharge, while domestic (gray) wastewater may be discharged directly or after chlorination.

Permittees report that sanitary and domestic wastewaters are discharged via the disposal caisson, and that any non-hazardous combustible domestic waste is incinerated on-board. Non-combustible domestic solid waste, such as metals and plastics are stored and transferred to an approved landfill or other approved site.

Drilling Fluids/Muds, Cuttings and Cement

Section 3.1.1 and 3.1.2 in the ODCE (USEPA and Tetra Tech 2013, pg. 13 and 14) contain a detailed description of the drill cuttings and fluids. These sections of the ODCE provide descriptions of the composition and quantity of potential discharges in addition to their modeled behavior in the marine environment. Section IV.B.1 of the draft proposed GP fact sheet presents the technology-based permit requirements for the control of drill cutting and drilling fluids. Section 6.1 of the ODCE contains a detailed description of the toxicity of the drilling fluids and cuttings.

The proposed GP authorizes the discharge of water-based drilling fluids/muds and additives. The permit prohibits the discharge of free oil and diesel oil or mineral oil-based drilling fluids/muds and limits the concentration of cadmium and mercury in stock barite that is added to drilling fluids. Drilling fluids/muds consist of water and a variety of additives (Table 3-1 in USEPA and Tetra Tech 2013, pg. 16); water makes up 75 to 85 percent of the volume of most drilling fluids/muds currently used in Cook Inlet. Operators may choose to use oil-based or synthetic-based fluids during exploration activities, but those drilling fluids cannot be discharged under the proposed GP and the discharge prohibition extends to all cuttings generated with oil-based drilling fluids. Since the discharge of oil- and synthetic-based fluids and cuttings associated with oil-based fluids is prohibited, these fluids are not discussed further.

Drill cuttings and drilling fluids/muds are discussed together as they are used together in the drilling process. Drill cuttings are rock particles broken loose by the drill bit and carried to the surface by drilling fluids that circulate through the borehole. The cuttings are composed of the naturally occurring solids found in subsurface geologic formations and to a much lesser extent, bits of cement used during the drilling process. Cuttings are separated from the drilling fluids by a shale shaker and other solids control equipment to remove the majority of solids and cuttings from the fluid.

When released into the water column, the drilling fluids and cuttings tend to separate into upper and lower plumes (MMS 2003, pg. III-17). The discharge of drilling fluids/muds at the surface ensures dispersion and limits the duration and amount of exposure to organisms (Menzie 1982; National Research Council 1983; both cited in MMS 2003, pg. III-18). Most of the solids in the discharge (> 90 percent) descend rapidly to the seafloor in the lower plume. The extent of seafloor area over which the discharged materials are deposited depends on the water depth, currents, and material particle size and density. In most areas of the OCS, the particles are deposited within 150 m of the discharge site; however, in Cook Inlet, which is considered a high-energy environment, the particles are deposited in an area more than 150 m below the discharge site (MMS 2003, pg. III-18). The physical disturbance of the seafloor caused by the deposition of drilling discharges can be similar to that caused by storms, dredging, disposal of dredged material, or certain types of fishing activities. The upper plume contains the solids and water-soluble components that separate from the material of the lower plume and are kept in suspension by turbulence. Dilution rates as high as 1,000,000:1 can occur for drilling solids within a distance to 200 m of a platform with surface currents of 30-35 centimeters per second (about 0.6-0.7 knots) (National Research Council 1983 cited in MMS 2003, pg. III-19).

The discharge of excess cement slurry at the discharge pipe will result from equipment wash-down after cementing operations at the seafloor surface. Excess cement slurry is discharged in small quantities during installation of the drill casing, and varies based on drilling conditions, the casing and testing program in effect. The proposed GP requires reporting of the total discharge volume of this waste stream and prohibits discharge of free oil.

This discharge may contain small amounts of drilling fluids that remained adhered to the surface of the cuttings after the solids separation process. The main source of pollutants in drill cuttings are associated with the drilling fluids that adhere to the rock particles (USEPA 2000 cited in the Fact Sheet, pg. 11).

Water-based fluids are approximately 50 to 90 percent water by volume. There are eight generic types of these fluids which are described in Section 3.1.2.1 in the ODCE (USEPA and Tetra Tech 2013). The presence of potentially toxic trace elements in drilling fluids and adherence to cuttings is a concern. Barite is a component of generic fluid formulations ranging from 0 to 450 pounds per barrel (lb/bbl). Barite is known to contain trace contaminants of several toxic heavy metals such as arsenic, cadmium, chromium, copper, lead, mercury nickel, and zinc (USEPA 2000) (Table 10). In order to control the concentration of heavy metals in drilling fluids, EPA promulgated regulations applicable to the offshore subcategory of the oil and gas industry in 1993 (40 CFR Part 435, Subpart A) requiring that stock barite meet the criteria limits of 3 milligrams per kilogram (mg/kg) for cadmium and 1 mg/kg for mercury.

Amounts Discharged

In general, exploratory facilities differ from new sources in that they do not discharge produced water. Moreover, the volume of drilling fluids and drill cuttings discharged from an exploratory facility is significantly less than from a development facility, where up to fifty wells can be drilled.

The discharge rate of drill cuttings and drilling fluids during well drilling operations is variable. The volume of rock cuttings produced from drilling is primarily a function of the depth of the well and the diameter of the bore hole (USEPA, 2000 cited in EPA and Tetra Tech 2013, pg. 25). USEPA (1987 cited in EPA and Tetra Tech 2013, pg 25) estimated that between 0.2 barrel and 2.0 barrels (8.4 to 84.0 gallons) of total drilling waste are produced for each vertical foot drilled. Washed drill cuttings and a small volume of drilling fluid solids are continuously discharged during drilling operations; the discharge rate varies from about 25 to 250 bbl/day (MMS 2003 cited in EPA and Tetra Tech 2013, pg. 25).

TABLE 10. METALS CONCENTRATIONS IN BARITE USED IN DRILLING FLUIDS

Metal	***Clean" Barite Concentrations (mg/kg")***
Aluminum	9,069.9
Antimony	5.7
Arsenic	7.1
Barium	359,747.0
Beryllium	0.7
Cadmium	1.1
Chromium	240.0
Copper	18.7
Iron	15,344.3
Lead	35.1
Mercury	0.1
Nickel	13.5
Selenium	1.1
Silver	0.7
Thallium	1.2
Tin	14.6
Titanium	87.5
Zinc	200.5
Source: USEPA 1993; Table XI-6	

According to the Programmatic EIS for the Cook Inlet (BOEM 2012, pg. 4-181) up to 6,000 barrels of drilling fluids and 7,200 tons of drill cuttings could be disposed of within the Cook Inlet Planning Area from all potential future wells. For the Cook Inlet Sale 191 area, it is estimated that the average exploration well will use about 140 tons of dry mud and produce approximately 400 tons of rock cuttings; the average development or service well will use approximately 70 tons of dry mud and produce about 500 tons of cuttings. The yearly discharge on the basis of drilling 11 wells per year is estimated to be about 3,690 tons of drilling fluids and 5,590 tons of cuttings. The amount of suspended sediments is estimated to be 10 percent (928 tons) of the discharge (MMS 2003, pg. III-19).

These drilling fluids and cuttings would contain metals which would initially be suspended in the water column (causing turbidity) and would eventually partition out onto the substrate or be transported out of the Inlet over time. There is a concern about the amount of metals present in barite contained in drilling fluids and adsorbed onto drill cuttings and the potential effect of these metals on the aquatic environment.

The amount of barite (barium sulfate-$BaS0_4$) in the drilling fluids is estimated to be approximately 63 percent. Barium makes up about 59 percent of barite or about 37 percent of the drilling fluids/muds. For a single well discharging 330 tons of drilling fluids, the amount of barium discharged is estimated to be about 122 tons. EPA's limits the amount of mercury and cadmium in the barite to 1 mg/kg mercury and 3 mg/kg cadmium (dry weight); these limits are assumed to be the concentrations of mercury and cadmium in the discharged drilling fluids. The amount of mercury and cadmium discharged per well (based on 330 tons of drilling fluids per well) is estimated to be 0.12 kilograms and 0.36 kilograms, respectively.

In an attempt to quantify the loading of these metals in LCI EPA estimated the amount using the following information: 1) the amount of barite (lb/bbl) in four generic drilling fluid formulations, 2) the amount of each metal (mg) present in barite (kg), and 3) the number of barrels of drilling waste discharged on a daily basis (Tables 11-14). Additionally, EPA combined the metal estimates with empirical information collected from wells drilled in other locations in Cook Inlet to predict potential loading.

Discharge and loading estimates per well were derived by EPA using the NOI information submitted by Furie. In the NOI discharges rates were reported as barrels per day. EPA has used 20 days as the average number of days to drill an exploratory well. The volumes presented in the tables below provide a reasonable estimate of potential volumes that could be discharged for each waste stream during the 5-year term of the proposed GP. The estimated average and maximum discharge quantities are summarized in Table 12. Although these discharge numbers are representative of exploration activities in an area not covered by this proposed GP, EPA has chosen to use them as they represent the most recent discharge data in Cook Inlet.

Finally, the actual number of exploratory wells that will be drilled in the action area during the 5-year permit term is not known. EPA estimates the potential drilling of up to 12 wells as a high-end estimate according to existing information (BOEM 2012, pg. 4-278). Consequently, we provide loading estimates using the maximum discharge quantities for 12 wells over the course of the permit term (Table 13).

It's clear that the selection of drilling fluid significantly affects the quantity of metals discharged (Table 14). The drilling fluid containing 450 lbs of barite per barrel has 94 percent more metals than the drilling fluid that contains 25 lbs of barite. The concentration of barite is increased as the well is drilled deeper; this is because barite is a weighting agent used to offset reservoir pressures and so it's necessary to use the type of drilling fluids consistent with the required pressure levels (Neff 2008, pg. 185). Since different barite concentrations are used as the well is drilled some combination of fluids presented in Table 11 will likely be used in the exploration drilling depending on the depth of the well.

As indicated by the loading estimates in Table 14, 99.8 percent of the elements discharged over the course of the drilling period consist of the barium, iron and aluminum; the other 15 elements make up the remaining 0.2 percent. Mercury, the metal of greatest concern makes up a fraction of the total discharge.

If as indicated in BOEM (2012) 12 exploration wells may be drilled in the action area over the course of the permit term the maximum amount of the cadmium and mercury discharged into Cook Inlet could be 392 kg (178 lb) and 36 kg (16 lb), respectively (Table 13). This is based on very conservative assumptions including the maximum number of barrels (360,000) and the heaviest (450 lbs barite/bbl) drilling fluid used regardless of well depth and pressure as discussed previously. As will be discussed in the following sections not all of this material is expected to remain in the water column or in Cook Inlet.

TABLE 11. THE AMOUNT OF METALS (KG/BBL) IN BARITE CONTAINED IN VARIOUS GENERIC WATER-BASED DRILLING FLUID FORMULATIONS WITH BARITE RANGING FROM 25 LBS PER BARREL TO 450 LBS PER BARREL

Metal	***Clean Barite Concentrations***	***Seawater Lignosulfonate Fluid 25-450 lbs Barite***	***Seawater/Freshwater Gel Fluid 0-50 lbs Barite***	***Lime Fluid 25-180 lbs Barite***	***Seawater/Potassium/Polymer fluid 0-450 lbs Barite***
	(mg/kg)	kg/bbl	kg/bbl	kg/bbl	kg/bbl
Aluminum	9,069.90	5.0E-01	1.0E+00	3.6E+00	9.0E+00
Antimony	5.7	3.1E-04	6.3E-04	2.3E-03	5.6E-03
Arsenic	7.1	3.9E-04	7.8E-04	2.8E-03	7.0E-03
Barium	359,747.00	2.0E+01	4.0E+01	1.4E+02	3.6E+02
Beryllium	0.7	3.9E-05	7.7E-05	2.8E-04	6.9E-04
Cadmium	1.1	6.1E-05	1.2E-04	4.4E-04	1.1E-03
Chromium	240	1.3E-02	2.6E-02	9.5E-02	2.4E-01
Copper	18.7	1.0E-03	2.1E-03	7.4E-03	1.9E-02
Iron	15,344.30	8.4E-01	1.7E+00	6.1E+00	1.5E+01
Lead	35.1	1.9E-03	3.9E-03	1.4E-02	3.5E-02
Mercury	0.1	5.5E-06	1.1E-05	4.0E-05	9.9E-05
Nickel	13.5	7.4E-04	1.5E-03	5.3E-03	1.3E-02
Selenium	1.1	6.1E-05	1.2E-04	4.4E-04	1.1E-03
Silver	0.7	3.9E-05	7.7E-05	2.8E-04	6.9E-04
Thallium	1.2	6.6E-05	1.3E-04	4.8E-04	1.2E-03
Tin	14.6	8.0E-04	1.6E-03	5.8E-03	1.4E-02
Titanium	87.5	4.8E-03	9.6E-03	3.5E-02	8.7E-02
Zinc	200.5	1.1E-02	2.2E-02	7.9E-02	2.0E-01

Note: Used the maximum barite concentration in each formulation to predict the metal content with the exception of Seawater Lignosulfonate Fluid, used the minimum for this calculation.

TABLE 12. THE MEAN DISCHARGE QUANTITIES OF DRILLING FLUID BASED ON FURIES'S NOTICE OF INTENT OF 30,000 BARRELS PER WELL OVER THE COURSE OF THE DRILLING PERIOD (17 TO 21 DAYS).

Metals	***Clean Barite Concentrations***	***Seawater Lignosulfonate Fluid 25-450 lbs Barite***	***Seawater/Freshwater Gel Fluid 0-50 lbs Barite***	***Lime Fluid 25-180 lbs Barite***	***Seawater/Potassium/ Polymer fluid 0-450 lbs Barite***
	mg/Kg	Kg	Kg	Kg	Kg
Aluminum	9,070	14,965	29,931	107,750	269,376
Antimony	5.7	9	19	68	169
Arsenic	7.1	12	23	84	211
Barium	359,747	593,583	1,187,165	4,273,794	10,684,486
Beryllium	0.7	1.0	2.0	8.0	21
Cadmium	1.1	2.0	4.0	13	33
Chromium	240	396	792	2,851	7,128
Copper	18.7	31	62	222	555
Iron	15,344	25,318	50,636	182,290	455,726
Lead	35.1	58	116	417	1,042
Mercury	0.1	0.0	0.0	1.0	3.0
Nickel	13.5	22	45	160	401
Selenium	1.1	2.0	4.0	13	33
Silver	0.7	1.0	2.0	8.0	21
Thallium	1.2	2.0	4.0	14	36
Tin	14.6	24	48	173	434
Titanium	87.5	144	289	1,040	2,599
Zinc	200.5	331	662	2,382	6,947

Note: Used the maximum barite concentration in each formulation to predict the metal content with the exception of Seawater Lignosulfonate Fluid, used the minimum for this calculation.

TABLE 13. THE MAXIMUM DISCHARGE QUANTITIES BASED ON THE TOTAL DISCHARGE OF 360,000 BARRELS OF DRILLING FLUID FROM 12 WELLS OVER THE FIVE YEAR PERMIT TERM

Metals	***Clean Barite Concentrations***	***Seawater Lignosulfonate Fluid 25-450 lbs Barite***	***Seawater/Freshwater Gel Fluid 0-50 lbs Barite***	***Lime Fluid 25-180 lbs Barite***	***Seawater/Potassium/ Polymer fluid 0-450 lbs Barite***
	mg/Kg	Kg	Kg	Kg	Kg
Aluminum	9,069.90	179,584	359,168	1,293,005	3,232,512
Antimony	5.7	113	226	813	2,031
Arsenic	7.1	141	281	1,012	2,530
Barium	359,747.00	7,122,991	14,245,981	51,285,532	128,213,831
Beryllium	0.7	14	28	100	249
Cadmium	1.1	22	44	157	392
Chromium	240	4,752	9,504	34,214	85,536
Copper	18.7	370	741	2,666	6,665
Iron	15,344.30	303,817	607,634	2,187,483	5,468,709
Lead	35.1	695	1,390	5,004	12510
Mercury	0.1	2	4	14	36
Nickel	13.5	267	535	1,925	4,811
Selenium	1.1	22	44	157	392
Silver	0.7	14	28	100	249
Thallium	1.2	24	48	171	428
Tin	14.6	289	578	2,081	5,203
Titanium	87.5	1,733	3465	12,474	31,185
Zinc	200.5	3,970	7,940	28,583	71,458

Note: Used the maximum barite concentration in each formulation to predict the metal content with the exception of Seawater Lignosulfonate Fluid, used the minimum for this calculation.

TABLE 14. THE MINIMUM AND MAXIMUM DISCHARGE QUANTITIES OF DRILLING FLUID BASED ON FURIE'S NOTICE OF INTENT OF 30,000 BARRELS PER WELL OVER THE COURSE OF THE 120 DAY DRILLING PERIOD

Metal	*Min (kg)*	*Max (kg)*	*Min (lbs)*	*Max(lbs)*
Barium	593,583	10,684,486	269,810	4,856,585
Iron	25,318	455,726	11,508	207,148
Aluminum	14,965	269,376	6,802	122,444
Chromium	396	7,128	180	3,240
Zinc	331	6,947	150	3,158
Titanium	144	2,599	66	1,181
Lead	58	1,042	26	474
Copper	31	555	14	252
Tin	24	434	11	197
Nickel	22	401	10	182
Arsenic	12	211	5.0	96
Antimony	9.0	169	4.0	77
Thallium	2.0	36	1.0	16
Cadmium	2.0	33	1.0	15
Selenium	2.0	33	1.0	15
Beryllium	1.0	21	1.0	9.0
Silver	1.0	21	1.0	9.0
Mercury	0.2	3.0	0.1	1.0

5.2.1.2 Transport and Fate of Drilling Fluids and Drill Cuttings

Drilling fluids are composed of water-based, oil-based or synthetic-based materials. During exploratory-drilling operations, bulk drilling fluid, usually about 100–200 barrels at a time are discharged several times during the drilling of a well, when the composition of the drilling fluid has to be changed substantially, or when the volume exceeds the capacity of the fluid tanks. Under this proposed GP discharge is not authorized in the nearshore, the permit only authorizes discharges in federal waters three nm off shore.

Transport

The distribution of drill fluids and cutting in LCI will vary depending on the water depth, ambient current speed, discharge rate and volume, as well as the physical and chemical properties of the material (Houghton et al. 1984, pg. 169). There are three rip currents that travel through LCI and span approximately 13 miles across the channel. Moreover, the lower portion of Cook Inlet is influenced by the Alaskan Stream and by a parallel current in the western Gulf of Alaska called the Kenai Current or the Alaska Coastal Current (ACC). The ACC flows along the inner shelf in the western Gulf of Alaska and enters Cook Inlet and Shelikof Strait (Schumacher and Reed 1980; Royer 1981a, 1981b cited in USEPA and Tetra Tech 2013, pg. 28). As previously noted the rate of dilution and transport of discharged materials is affected by the hydrodynamics of the receiving water body. The hydrology of LCI suggests that the waters are vertically well mixed. According to (MMS 2003, pg. IV-16) “the currents associated with the Cook Inlet circulation regime, especially the strong tidal currents, and the morphometry of the inlet produce considerable crosscurrents and turbulence in the water column during both ebb and flood tides".

Because the exact location of the exploration well(s) is unknown it isn't possible to accurately predict the fate of drilling fluids/muds. Various modeling efforts have been conducted in LCI which informs our analysis of the transport and fate of drilling materials after they have been discharged (MMS 2003, pg. IV-16; EPA 2013; Houghton et al. 1984). Rapid dilution of discharges has been reported elsewhere for LCI. The NRC (1983, cited in MMS 2003, pg. IV-16) reports that dilution rates up to 1,000,000:1 for drilling solids within 200m (600 ft) of the drilling vessel when currents are 0.6 to 0.7 knots. Modeling of discharges at depths deeper than 40 m (120 ft) at discharge rates of 500, 750 and 1,000 barrels/hour and current speeds of 0.06 to 5.0 ft/sec (2 to 150 cm/sec; about 0.04 to 3 knots) resulted in dilution ranging from 1,000:1 to 6,000:1 at 100 m (300 ft). Modeling projections of dissolved materials showed that dilution rates ranged from 1,000:1 and 27,000:1 (MMS 2003, pg. IV-16).

In 1977 a COST well was drilled in LCI between Kachemak and Kamishak bays in water approximately 50 m (150 ft) deep (Dames and Moore 1978 cited in MMS 2003, pg. IV-16). A dye study and modeling effort was conducted to track the plume and estimate dilution of the drilling fluids/muds discharged. In the location where the COST well was drilled (which is in the action area) strong tidal currents rapidly dispersed the larger particles of drilling fluids/muds and cuttings; the current velocity in this location was approximately 2 knots. Dilution was rapid to a minimum value or 10,000:1 within 100 m (300 f) of the drilling vessel. The concomitant increase in turbidity was calculated to be 8 ppm in the location where the background suspended sediment ranged from 2 to 20 ppm.

The Offshore Operators Committee (OOC) and Exxon Production Research Company have developed a model (the OOC model) that has been used extensively in Alaskan waters to predict the transport and deposition of drilling fluid. Comparison of model results with field observations reveal that the model is capable of predicting many important aspects of the drilling fluid discharge plume behavior. When released into the water column, the drilling fluid separates into an upper plume, which contains fine-grained solids, and a lower plume, which contains the majority of heavier solids. The fate and transport of cuttings are not predicted by the OOC model. These materials are expected to be of coarser grain size than drilling fluids and will therefore, settle more rapidly to the seafloor. Model simulations of drilling fluid discharges in Cook Inlet show that both solids and dissolved components are diluted rapidly with distance from the point of discharge. At 100 m (328 ft) from the point of discharge, the dilution factors ranged from 905 to 5,793 for discharges in water depths ranging from 40 m (131 ft) to 120 m (394 ft) (Tetra Tech 1993 as cited in Tetra Tech 2006). Dilution factors for dissolved components ranged from 1,285 to 9,127 for discharges to the same range of water depths (Tetra Tech 1993 as cited in Tetra Tech 2006).

Transport modeling done on the late 1970's and reported in Houghton et al. (1984, pg. 169) provides a general description of the potential behavior of the discharges in the lower Inlet. Houghton et al. (1984, pg. 167) discuss fate in two time periods, initial fate and dispersion and ultimate. Once discharged the plume is quickly diluted by many orders of magnitude 100 m (300 ft) down current from the drilling operation. Once diluted however, the fine (micron-sized) particles are anticipated to remain in the water column indefinitely until flocculation or adherence to suspended sediments causes them to settle out; this behavior is attributed to the current patterns in LCI. Gross circulation will ultimately transport the particles out of the Inlet into the Gulf of Alaska within approximately 10 months (Houghton et al. 1984, pg. 167; Kinney, Button and Schell 1969, 1970, as cited in MMS 2003, pg. IV-16). According to Feeley et al. (1980, cited in Houghton et al 1984, pg. 168) 80 percent of the fine-grained particles entering Cook Inlet do not remain in the Inlet but are carried out through Stevenson Entrance to be deposited into northern Shelikof Strait.

Some amount (20 percent suggested) of the drilling fluids/muds and cuttings will remain in the inlet. The particles that settle out may be resuspended during peak flow on the tidal change until such time as they are moved to locations where the near-bottom currents are less that the critical velocities for resuspension (Houghton et al, 1984, pg 168). The proposed GP does not allow discharge in numerous locations (see Section 2.3.1) to protect sensitive areas and species and to avoid the deposition of drilling cuttings and fluids in the nearshore.

Fate of Drilling Fluids and Drill Cuttings

Similar to transport, fate or deposition of fluids and cutting will depend on the location of the discharge in the water column, water depth, currents, discharge rate and volume and the characteristics of the material. Houghton et al. (1984, pg. 169) report on field investigations of exploratory drilling operations which suggest that a conservative estimate of deposition rate is 50 g/m^2/day for a distance of 50 to 100 m (150 to 300 ft) from the discharge site. Assuming a well is active for 90 days then total amount of solids accumulation would be approximately 0.9 to 4.5 kg/m^2 (0.41 to 2.0 lbs/10.8 ft^2) or approximately equivalent to 0.4 to 2.2 mm (0.02 to 0.09 inch) deposition on the substrate. This is an over estimation based on the average 20 days of drilling reported in the ODCE (USEPA and Tetra Tech 2013, pg. 25).

Dames and Moore (1978 cited in Houghton et al. 1984, pg. 170) collected drill cuttings discharged from the COST well in LCI; these were large particles greater than 0.85 mm (0.03 inch). They measured accumulations of 30, 10.2 and 0.8 g/m^2/day in the sandy substrate at distances of 100, 200 and 400 m (300 ft, 600 ft and 1,200 ft), respectively. They noted that these materials primary remained in the top 10 cm (4 inches). Through the movement of currents and tides the materials were continuously reworked along with the natural sediments. In areas with hard uneven bottom (gravel and cobble) the drilling fluids/muds and cuttings may be trapped in crevices until either strong tides or storm events resuspends and transports them to deeper water or outside the Inlet (Houghton et al. 1984, pg. 170).

The OOC modeling effort used to predict dilution within the 100m mixing zones for drilling in the Beaufort and Chukchi Seas was reviewed to get an idea of the amount of deposition that could be expected for the current permit (Tetra Tech 2011). The maximum thickness of the drilling fluid solids within 100 m (300 ft) of the discharge did not exceed 0.4 cm (0.16 inch) for all model runs varying water depth, current speed, discharge depths and rate (up to 750 bbl/hr).

Only a portion of the solids in the drilling fluids and cuttings discharged into Cook Inlet may accumulate near the discharge. The bottom currents in LCI are strong enough to prevent the deposition of sand-size and smaller particles (Sharma 1979; Hampton 1982 as cited in the EPA and Tetra Tech 2013, pg. 101).

The general southwest flow of Cook Inlet currents likely entrains the dissolved fraction of the discharge and may ultimately transport it out of Cook Inlet into the Gulf of Alaska within about 10 months (MMS 2003).

Chemically Treated Sea Water Discharges

Operators use a broad range of chemicals to treat seawater and freshwater used in offshore operations. The available literature shows that more than twenty biocides are commonly used. These include derivations of aldehydes, formaldehyde, amine salt, and other compounds. The toxicity of these compounds to marine organisms as measured with a 96-hour LC_{50} (lethal concentration to 50% of test organisms) test is reported to range from 0.4 mg/L to greater than 1000 mg/L. Scale inhibitors are also used to treat seawater and freshwater. The scale inhibitors commonly used are amine phosphate ester and phosphonate compounds. Scale inhibitors are generally less toxic to marine life than biocides with 96-hour LC_{50} concentrations shown to be from 1,676 mg/L to greater than 10,000 mg/L. 96-hour LC_{50} values for corrosion inhibitors were reported to range from 1.98 mg/L to 1050 mg/L.

The 2007 Cook Inlet NPDES general permit used generic Best Professional Judgment-based limits, based on available technology to regulate chemically treated sea water and fresh water discharges, rather than attempting to limit the discharge of specific biocides, scale inhibitors and corrosion inhibitors; the proposed GP retains these limitations.

Many of the chemicals normally added to seawater or freshwater, especially biocides, have manufacturer's recommended maximum concentrations or EPA product registration labeling. In addition, information obtained from offshore operators demonstrates that it is unnecessary to use any of the chemical additives or biocides in concentrations greater than 500 mg/L.

Concentrations of treatment chemicals in discharges of sea water or fresh water are limited in the proposed GP to the most stringent of the following EPA requirements:

- The maximum concentrations and any other conditions specified in the EPA product registration labeling if the chemical additive is an EPA-registered product.
- The maximum manufacturer's recommended concentration when one exists.
- A maximum concentration of 500 mg/L.

The proposed GP contains best conventional pollution control technology limits prohibiting the discharge of free oil for chemically-treated seawater and freshwater discharges and also contains a visual sheen monitoring requirement for miscellaneous discharges after they are run through an oil-water separator. The proposed Cook Inlet Exploration general permits require reporting of the total discharge volume of this waste stream and require that there is no discharge of free oil in the discharge.

5.2.1.7 Treatment

Treatment and other limitations on "other discharges" should minimize the pollutant loading and receiving water concentrations. The other discharges are described in detail in Section 3.0 of the ODCE (EPA and Tetra Tech, 2013) and Section 5.2.1. There are effluent limitations and treatment requirements for most of these discharges. In all cases EPA requires that no free oil is detected using a sheen test. USEPA (1993) determined that the best practicable control technology currently available for treatment of deck drainage is a sump and skim pile system. Oil and water are gravity-separated in the sump, and the oil is sent off-site to an oil treatment unit. After treatment in an oil water separator, clean water is discharged, and oily water is stored onboard until transferred to an approved treatment and disposal site. Untreated deck drainage can contain oil and grease in quantities ranging from 12 to 1,310 mg/L. However, the proposed GP does not allow the discharge of deck drainage unless it complies with the effluent limitations specified in the permits. Ranges for other pollutant quantities in untreated deck drainage are provided in the draft general permit[8].

The proposed Cook Inlet Exploration general permit allows the discharge of sanitary and domestic wastes provided effluent limitations are met. Sanitary wastewater must be treated with an approved MSD prior to discharge, while domestic (gray) wastewater may be discharged directly or after chlorination. The primary constituents of blowout preventer fluid are oil (vegetable or mineral) or seawater mixed with an antifreeze solution (ethylene glycol). The proposed Cook Inlet Exploration general permit allows the discharge of this waste stream, but requires that no free oil is detected using a sheen test, as described in the permit. Other miscellaneous discharges require treatment through the oil-water separator prior to discharge at the disposal pipe.

5.2.1.3 Water quality

As previously discussed, LCI is a high energy environment with significant current speed and tidal exchange. The lower portion of Cook Inlet is influenced by the Alaskan Stream and by a parallel current in the western Gulf of Alaska called the Kenai Current or the ACC (MMS 2003 cited in EPA and Tetra Tech 2013). The ACC flows along the inner shelf in the western Gulf of Alaska and enters Cook Inlet and Shelikof Strait (Schumacher and Reed 1980; Royer 1981a, 1981b all cited in the EPA and Tetra Tech, 2013). The current is narrow (less than 30 km (18.6 mi)) and high-speed (20–175 centimeters per second (cm/s) or 8 – 69 in/s)) with flow that is driven by fresh water discharge and inner-shelf winds. Peak velocities of 175 cm/s (69 in/s) occur in September through October (Johnson et al. 1988, cited in the EPA and Tetra Tech, 2013).

Drilling fluids and cutting discharged into these waters are quickly diluted within close proximity of the drilling vessel. Previous modeling exercises by Dames and Moore (1978, cited in Houghton et al., 1984, pg. 54; NRC 1983, MMS 2003, pg. IV-16) and dye studies conducted during well drilling indicated rapid dilution to a minimum value of 10,000:1 within 100 m (300 ft) of the discharge point when the currents exceed 5 cm/sec. Additionally, only a portion of the metals in the discharge are in the dissolved form and would remain in suspension for any length of time. EPA anticipates that due to the high level of dilution the surface water concentrations of metals (particularly the dissolved fraction) within the drilling fluids/muds would quickly reach levels that would not compromise water quality or result in toxicity to ESA-listed or candidate species or their prey. The question remains as to the ultimate fate of the significant load (Table 13) of fluids/muds and cuttings that may be discharged when all exploration wells are fully operational within the action area.

Drilling fluids and cuttings discharged into Cook Inlet would increase both the turbidity of the water column and the rate of accumulation of particulate matter on the seafloor in the vicinity of the drilling vessel. Most of the solids in the discharge (more than 90 percent) are predicted to descend rapidly (within 1 hour) to the seafloor as part of the lower mud plume (MMS 2003). Dye studies and modeling of the discharge plume associated with the drilling of a well in LCI during 1977, at a site between Kachemak and Kamishak bays, demonstrated rapid dilution to a minimum value of 10,000:1 within 100 m of the drilling vessel (MMS 2003). Following dilution, the increase in turbidity was estimated to be about 8 ppm; background turbidity in the area ranged from 2-20 ppm.

The finer grained material that does not rapidly settle may remain in suspension by turbulence or settle to the seafloor farther away from the point of discharge. These particulates can cause an increase in turbidity. However, in general, the concentration of suspended particulate matter in the water column is expected to be reduced to levels comparable to naturally occurring suspended particulate matter (1-50 ppm) within about 100-200 m of the discharge site (MMS 2003).

5.2.1.4 Bioavailability

The primary concern with the discharge of large quantities of drilling fluids/muds and cuttings relate to the potential for dissolution of these trace metals from the barite. The potential exposure pathways to ESA-listed and candidate species are through bioconcentration through surface water and bioaccumulation through the food web. The potential for exposure through either of these pathways depends on the bioavailability of the metals. The metals of concern most frequently mentioned are cadmium and mercury. EPA has limited the concentrations of cadmium and mercury in barite used in drilling fluids discharged into marine waters to 3 and 1 mg/kg, respectively. However, other metals present in barite have the potential to bioaccumulate in the food web; these metals are also discussed below.

The majority of metals detected in drilling fluids/muds are present principally as trace impurities in barite, bentonite clay or drill cuttings (Neff 2008, pg. 185), specifically insoluble mineralized salts (Kramer et al 1980; Trefry et al 1986; Leuterman et al. 1997; Trefrey and Smith 2003, all cited in Neff 2008). These metals are not readily bioavailable due to the presence of high sulfate concentrations in seawater.

In order to predict the available fraction of the metals associated with water-based drilling fluids Deuel and Holliday (1998 cited in Neff 2010, pg. 127) fractionated the metals into lightly adsorbed/dissolved fractions and tightly bound, insoluble fraction. They demonstrated that 78 percent, 97 percent, 71 percent, 58 percent, 36 percent and 53 percent of arsenic, barium, cadmium, chromium, lead and zinc, respectively were completely unavailable for bioaccumulation from water-based drilling fluids. Less than 4.5 percent of the metals were considered exchangeable (Neff 2010, Table 6.1). Deuel and Holliday (1998, as cited in Neff 2010) concluded that the majority of the total metals were bound with the organic/sulfide complexes or the residual fraction which are both considered unavailable for bioaccumulation by marine species. This low solubility reduces the uptake and transport of these metals in the food web and reduces their toxicity to aquatic organisms (Neff 2008, pg. 13).

Crecelius et al.(2007) conducted a study of the solubility of barite and the release of trace metals into the marine environment in the Gulf of Mexico. They examined the dissolution of barite and associated metals in oxygenated water and in anoxic sediment under various conditions; these conditions included static and flowing water, oxygenated and anaerobic sediments and acidic and basic pH. They found that a relatively small amount of mercury, cadmium, copper, lead and zinc in barite are soluble at pH ranging from 7.3 to 8.3. Specifically, their measurements revealed that less that 1 percent of copper, mercury and lead, 3 percent of zinc and 15 percent of cadmium dissolved from the barite (Crecelius et al. 2007, pg. 97). The authors compared the metal concentrations in seawater to the USEPA Marine Water Quality Criteria and found that only copper and lead exceed the criteria for metal-rich samples, 189 mg/kg barite and 1,368 mg/kg barite, respectively. These copper and lead concentrations are orders-of-magnitude higher than the concentrations in barite that were the basis for the cadmium and mercury limitations in the offshore subcategory (USEPA and Tetra Tech 2013, pg. 13). Based on their evaluation and comparison to the Water Quality Criteria, Crecelius et al. (2007, pg. 97) concluded that concentrations the low releases of metals from barite are not likely to cause effects to marine organisms from exposure to surface water.

Trace metals are present in barite which is a significant component of drilling fluids/muds. Barite is known to contain trace contaminants of several toxic heavy metals. These metals are present in “clean barite” at low concentrations; arsenic, cadmium, and mercury at less than 10 mg/kg; copper and nickel at less than 20 mg/kg, lead at 35 mg/kg, and the highest chromium and zinc are less than 250 mg/kg (See Table 10). Researchers have demonstrated that these metals are complexed with sulfide significantly reducing the dissolved fraction. The low dissolved fraction and high dilution rate of 10,000:1 within 100 m (300 ft) of the discharge point likely render these metals undetectable within the water column within close proximity to the discharge vessel.

Crecelius et al. (2007) and Neff (2008, 2010) report that the metals in barite are complexed with sulfides and other oxides. This complexation essentially binds the metals, rendering them unavailable for uptake by aquatic organisms. Under conditions of low oxygen and pH a portion of the metals are desorbed and can be present in the dissolved form in sediment pore water. Under these conditions the metals may be taken up by benthic organisms. The action area is 3 nm offshore in a high energy environment, discharges are prohibited in areas where drilling fluids/muds and cuttings might settle in locations with lower dissolved oxygen than is present within the Inlet itself.

Bioaccumulation

The sources of organic and inorganic contaminants in Cook Inlet include municipal (wastewater treatment), stormwater (point and non-point discharges) and industrial (including petroleum) discharges. Additionally, the glacial fed river and streams add a background load of naturally occurring inorganic materials to the Inlet. Although surveys have been conducted to evaluate water and sediment quality, to the best of our knowledge a loading allocation study has not been completed for Cook Inlet to determine which source has the greatest influence on the contaminant load.

Currently, oil and gas activities are confined to the upper Inlet. According to EPA (2003, pg. 1) 13 platforms were productive as of March 1996 (Figure 6). Together they produced 37,400 barrels of oil per day and 385,000,000 ft^3 of gas per day. Of the 13 active platforms, five separate and treat production fluids (oil, gas and water) at the platform and discharge produced water directly to receiving waters within Cook Inlet. The remaining eight facilities pipe the production fluids to three shore-based based facilities which treat and discharge the waste. The third facility sends it's treated produced water back to a platform for discharge. These three facilities treat and discharge 96 percent of the produced water generated from all platforms in Cook Inlet (EPA 1996 as cited in EPA 2003, pg. 1).

TABLE 15. MEAN METAL/METALLIOD CONCENTRATIONS (MG/KG) IN SALMON TISSUES FROM TYONEK AND CLAMS AND MUSSELS FROM COOK INLET (EPA 2003A)

Metal/Metalloid	***Sockeye***	***Chinook***	***Clams/Mussels***
Arsenic (Total)	0.29	0.658	2.34
Barium	0.27	0.139	0.565
Cadmium	0.026	0.098	0.236
Chromium	0.179	0.138	0.756
Lead	<0.02	0.042	0.043
Mercury	<0.02	0.04	0.013
Methylmercury	0.036	0.034	0.004
Selenium	0.593	0.346	0.331

The average concentration of total metals in fish and invertebrates (clams, mussels) ranged from 1.4 to 5.8 mg/kg and 0.3 to 8.4 mg/kg, respectively (EPA 2003, pg.19, pg. 22). Barium, aluminum and iron are the major constituents in clean barite drilling fluids followed orders of magnitude by chromium and zinc and the other metals and metalloids. Of these three major constituents only barium was measured in fish and invertebrate tissues, with mean concentrations below 1 mg/kg (Table 15). Arsenic (total), barium, cadmium, chromium and selenium, were detected in all eight invertebrate tissue samples. Lead was detected in all tissues as well, except for steamer clams. Based on the limited sampling in upper Cook Inlet the metals commonly reported in drilling fluids and cuttings do not appear to be accumulating in tissues to elevated levels (mean below 1 mg/kg). Arsenic was present at the highest concentrations and it is present in drilling fluids at 7.1 mg/kg (Table 11). Of course it would be necessary to conduct a risk assessment to predict the risk to ESA-listed and candidate species from consuming prey that may have bioaccumulated contaminants.

The data presented above are not robust enough to determine what the source of the metals is in the tissues that were collected. It is merely a snapshot of the amount of uptake that is occurring. Since tissues were not collected from a reference area it is not possible to compare these tissue concentrations to background levels. We are not able and nor have others attributed the contaminants measured in biota to any particular industry. There are many sources of these materials in the Inlet and each source contributes to a cumulative loading that partitions in the aquatic environment.

The State of Alaska supported by funding from EPA, NOAA and BOEM have analyzed a variety of fish species and clams for trace metals, dioxins and furans, organochlorine pesticides, PCBs and brominated fire retardants[9]. The sampling targeted important subsistence species. According to these data metals are not bioaccumulating to any great degree (most less than 1 mg/kg ww) in the tissues of species that would be considered prey for ESA-listed and Candidate species (Table 16 and 17).

Additionally, the Agency for Toxic Substance and Disease Registry (ATSDR) conducted an evaluation of seafood data collected from Cook Inlet near native villages and while these data are not entirely pertinent to ESA-listed and candidate species the results can be used to inform this analysis. Fish tissues collected for extrapolation to human health are processed differently, in general only tissues (i.e. fillet) consumed by humans are analyzed while whole body tissue data are analyzed for wildlife (Table 16). ATSDR concluded that arsenic, barium (not measured by ADEC for wildlife), cadmium, chromium, selenium and methylmercury were not present at levels which would result in a human health concern. Levels of metals, and other chemicals were detected at concentrations measured in fish from other parts of Alaska and from grocery stores in the U.S.

Generally, contaminants found at levels protective of human health are also considered to be protective of wildlife. Of course it would be necessary to conduct a risk assessment to definitively predict the risk to ESA-listed and candidate species from consuming prey that bioaccumulate contaminants. However, the levels detected in tissues presented in Tables 16 and 17 are low and in most cases less than 1 ppm.

Chemical Toxicity

The response of an organism to a chemical depends in part of the magnitude of the concentration in the media and the duration of exposure to that media. Section 6.1 of the ODCE (EPA and Tetra Tech, 2013) contains a detailed review of the toxicity of drilling fluids on marine species; we refer the reader to the ODCE for the detailed information. The following sections include a summary of the information presented in that document.

5.2.1.5 Sediment Quality

Once drilling fluids/muds and cuttings settle out they can modify sediment characteristics, biogeochemical functions and smother benthic organisms (MMS 2003, pg. 4-264). The degree to which sediment quality is affected by the discharge of drilling fluids/muds and cutting depends on the amount discharged (bbl/day), the size of the particles and their settling velocity. Impact to the benthic community can occur through burial, changes in the substrate composition and direct toxicity.

The ODCE (EPA and Tetra Tech, 2013) provides estimates of the amount of drilling fluids cuttings that may be discharged; these values were used to predict the loading of various metals in Cook Inlet (Table 12 and 13). The degree to which these materials build up on the substrate depends on the currents and tides in the Inlet. Houghton et al. (1984, pg. 12 and 13) describes the dynamic conditions of central Cook Inlet which “precluded formation of any cuttings pile and where cutting were widely distributed and entrained vertically into the seabed”, and “where no prolonged accumulation of mud or cuttings is possible”. In less dynamic environments within the action area localized effects to the benthic community are possible.

[9] http://dec.alaska.gov/eh/vet/fish.htm

Deposition of drilling fluids and cuttings has been measured in the field and estimated through modeling. In general, results of the far-field (100 to 400 m; 300 to 1,200 ft) discharge indicate that materials have not/would not build up to a significant level. Houghton et al. (1984) present the results from numerous studies which either measured or modeled the deposition of drilling solids.

Houghton et al. (1984, pg. 169) report on field investigations of exploratory drilling operations which suggest that conservative estimate of deposition rate is 50 g/m^2/day for a distance of 50 to 100 m (150 to 300 ft) from the discharge site. They assumed a well active for 90 days would accumulate approximately 0.9 to 4.5 kg/m^2 (0.41 to 2.0 lbs/10.8 ft^2) or approximately equivalent to 0.4 to 2.2 mm (0.02 to 0.09 inch) deposition on the substrate. A buildup of 0.4 mm would cover an area of 200 hectares (494 acres), whereas a buildup of 2.2 mm would cover an area of 36 hectares (90 acres).

Dames and Moore (1978; cited in Houghton et al. 1984, pg. 170) collected drill cuttings discharged from the COST well in LCI; these were large particles greater than 0.85 mm. They measured accumulations of 30, 10.2 and 0.8 g/m^2/day in the sandy substrate at distances of 100 m, 200 m and 400 m (300 ft, 600 ft and 1,200 ft), respectively from the point of discharge. Sediment traps deployed 100 m (300 ft) from the discharge point measured a depositions rate of 13 g/m^2/day (Dames and Moore 1978 cited in Houghton et al. 1984, pg. 56).

The OOC modeling effort used to predict dilution within the 100 m (300 ft) mixing zones for drilling in the Beaufort and Chukchi Seas was reviewed to get an idea of the amount of deposition that could be expected for the current permit (Tetra Tech 2011). The model output revealed that the maximum thickness of the drilling fluid solids within 100 m (300 ft) of the discharge would not exceed 4 mm (0.16 inch) for all model runs varying water depth, current speed, discharge depths and rate (up to 750 bbl/hr). The potential accumulation in the Beaufort and Chukchi Sea's would likely be higher than Cook Inlet due to the hydrodynamics of the lower Inlet.

In general, the level of deposition at the edge of the 100 m (300 ft) mixing zone ranges from 13 g/m^2/day to 50 g/m^2/day and a thickness of 2 to 4 mm deep. The level of accumulation in the near-field is likely higher for some locations in LCI where impacts to sediment quality and the benthic community may occur. Only a portion of the solids in the drilling fluids and cuttings discharged into Cook Inlet may accumulate near the discharge. The bottom currents in LCI are strong enough to prevent the deposition of sand-size and smaller particles (Sharma 1979; Hampton 1982, as cited EPA and Tetra Tech 2013, pg. 101).

As presented above a significant buildup of drilling fluids and cuttings is not expected to occur but instead will tend to disperse into a thin layer (2 to 4 mm deep) atop the substrate. Through the movement of currents and tides the materials will be continuously reworked along with the natural sediments. In areas with hard uneven bottom (gravel and cobble) the drilling muds and cuttings may be trapped in crevices until either strong tides or storm events resuspends and transports them to deeper water or outside the Inlet (Houghton et al. 1984, pg. 170).

TABLE 16. METAL AND METALLOID CONCENTRATIONS IN ALASKA FISH AND INVERTEBRATES (AUGUST 2011)

Species	***N***	***Metal/Metalloid (mean ± Std) (mg/kg ww) Whole body***						
		Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Selenium
Pacific Herring (*Clupea pallasii*)	11	1.8 (0.48)	0.022 (0.009)	No Data	0.86 (0.12)	No Data	No Data	0.48 (0.14)
Eulachon (*Thaleichthys pacificus*)	7	0.93 (0.039)	0.023 (0.004)	No Data	1.1 (0.14)	No Data	No Data	0.17 (0.023)
Rainbow smelt (*Osmerus mordax*)	10	1.4 (0.56)	0.013 (0.006)	No Data	0.5 (0.11)	No Data	No Data	0.45 (0.077)
Capelin (*Mallotus villosus*)	1	0.82	0.028	No Data	0.47	No Data	No Data	0.37
Pacific sand lance (*Ammodytes hexapterus*)	1	0.83	0.058	No Data	0.83	No Data	No Data	0.86
Saffron Cod (*Eleginus gracilis*)	10	6.0 (1.4)	0.019 (0.007)	No Data	0.91 (0.26)	No Data	No Data	0.76 (0.13)
Kelp Greenling (*Hexagrammos decagrammus*)	11/6	0.74 (0.28)	0.023 (0.022)	0.41 (0.39)	0.56 (0.5)	0.43 (0.27)	No Data	0.30 (0.082)
Rock Greenling (*H. lagocephalus*)	14	0.76 (0.31)	0.035 (0.049)	0.25 (0.054)	0.51 (0.12)	0.28 (0.22)		0.34 (0.047)
Atka Mackerel (*Pleurogrammus azonus*)	4	0.95 (0.2)	0.073 (0.039)	0.4 (0.14)	0.61 (0.08)	0.32 (0.074)	No Data	0.58 (0.057)
Northern Rock Sole (*Lepidopsetta polyxystra*)	13	2.1 (0.93)	0.026 (0.019)	0.26 (0.064)	0.52 (0.32)	0.41 (0.32)	0.051 (0.04)	0.44 (0.19)
Chinook Salmon (*Oncorhynchus tshawytscha*)	10	0.28 (0.31)	0.023 (0.01)	No Data	0.68 (0.11)	No Data	No Data	0.56 (0.09)
Chinook Salmon	15	0.44 (0.15)	0.13 (0.057)	No Data	1.0 (0.28)	No Data	No Data	0.37 (0.088)
Sockeye Salmon (*O. nerka*)	12/4/8	0.28 (0.089)	0.03 (0.012)	0.2 (0.13)	7.3(1.6)	0.22 (0.064)	No Data	0.56 (0.13)
Coho Salmon (*O. kisutch*)	8	0.18 (0.1)	0.019 (0.014)	No Data	1.6 (1.2)	No Data	No Data	0.54 (0.23)
Coho Salmon	93/4/89	0.34 (0.13)	0.045 (0.04)	0.16 (0.1)	1.2 (0.7)	0.23 0.15)	0.029 (0.29)	0.41(0.087)

Species	N	Arsenic	Cadmium	Chromium	Copper	Nickel	Lead	Selenium
Pink Salmon (*O. gorbuscha*)	186	0.3 (0.13)	0.005 (0.001)	0.066 (0.13)	0.73 (0.17)	0.027 (0.013)	No Data	0.25 (0.11)
Pacific Littleneck Clam (*Protothaca staminea)*	4	3.6 (0.49)	0.4 (0.047)	0.24 (0.11)	No Data	0.38 (0.014)	No Data	0.62 (0.13)
Geoduck Clam (*Panopea generosa*)	7	4.5 (0.87)	1.2 (0.24)	0.62 (0.17)	No Data	0.23 (0.07)	No Data	1.8 (0.41)
Pacific Oyster (*Crassostrea gigas*)	16	1.8 (0.48)	2.5 (1.1)	0.059 (0.035)	No Data	0.12 (0.045)	0.038 (0.021)	0.55 (0.1)

From: Alaska Department of Environmental Conservation, Fish Monitoring Program

TABLE 17. MERCURY CONCENTRATION IN ALASKA FISH AND INVERTEBRATES (AUGUST 2011)

Species	N	ND	Mean ± Std Dev
Great Sculpin (*Myxocephalus polyacanthocephalus*)	1	0	0.068
Pacific Herring	11	1	0.016 (0.004)
Eulachon	7	7	
Rainbow smelt	10	1	0.019 (0.007)
Capelin	1	1	
Pacific sand lance	1	1	
Saffron Cod	10	0	0.019 (0.008)
Kelp Greenling	8	0	0.27 (0.16)
Rock Greenling	14	0	0.11 (0.081)
Atka Mackerel	4	0	0.048 (0.11)
Northern Rock Sole	14	0	0.06 (0.024)
Chinook Salmon	10	3	0.029 (0.022)
Chinook Salmon	15	0	0.044 (0.015)
Sockeye Salmon	12	0	0.036 (0.007)
Coho Salmon	8	3	0.024 (0.025)
Coho Salmon	93	14	0.028)0.013)
Pacific Littleneck Clam	4	1	0.011 (0.004)
Pacific Blue Mussel (*Mytilus trossulus*)	23	4	0.018 (0.012)
Pacific Oyster	16	4	0.012 (0.006)

Some fraction of the metals contained within these materials can dissolved into the sediment pore water under anoxic conditions where the pH in lower. Additionally, some fraction of the metals can be desorbed within the acidic gut of benthic invertebrates as suggested by Crecelius et al. (2007). This bioavailable fraction can lead to the toxicity of the metal.

In order to protect the nearshore and sensitive habitats this general permit prohibits discharges in waters with a depth less than 9.1 m (30 ft) because these shallow water discharges are less dispersed than in deeper water, and thus have a greater potential to impact the abundant aquatic life found in these shallow waters. Additionally, discharges are prohibited in parts of Kamishak Bay because it is either an area of high resource value, or adjacent to areas of high resource value. Finally, Kamishak Bay is a known net depositional environment where drilling mud solids and other pollutants would likely accumulate if discharges are authorized.

The general permit authorizes discharges in federal waters 3 nm (4,828 m) from shore. The larger particles (>micron-sized) will likely settle out in the vicinity (100 to 400 m) of the discharge location while the dissolved particles will be entrained in the water column and some proportion will be transported out of the Inlet. This prohibited area restrictions (see Section 2.3.1) effectively prevents the bulk deposition of material in designated critical habitat and where ESA-listed species are primarily found.

5.2.2 Oil Spills

The release of oil into the environment (as a result of accidental spills) is known to cause impacts to local wildlife, communities and sensitive habitats. This is the reason that the proposed GP does not authorize discharge of any hydrocarbons. However, issuance of the permit enables oil and gas exploration which will have interrelated activities that could result in oil spills. Spills are inherent in exploration and development of oil and gas which is why the effects of spills are evaluated in NEPA documents (BOEM 2012; MMS 2003). These documents have categorized oil spills into small or large spills and their probability of happening during oil and gas exploration has been predicted.

5.2.2.1 Likelihood of a Spill

The potential for exposure and effects of ESA-listed and candidate species to oil spills depends of the frequency, magnitude and location of the spill. BOEM (2012) considered the potential for accidental spills and releases for all phases of the exploration and drilling process in the Programmatic EIS for the OCS Leasing Program. In that analysis BOEM (2012, pg. 4-7) anticipated a “low potential” for a catastrophic oil spill to occur during the program, although they evaluated this scenario in the EIS. In their analysis MMS (2003) also noted that a large spill is not likely during exploration activities, that if such a spill were to occur it would be during production. NMFS (2012, pg. 50) summarized the number type and volume of oil spills and gas blowouts in Cook Inlet in their Biological Opinion for the Section 7 Consultation on the 3-D Seismic Surveys of Cook Inlet. They cite offshore oils spill records from 1994 to 2011 which note that only three small spills (less than 10 gal) occurred during oil exploration; as a result NMFS stated that there is a low probability of an oil spill.

MMS (2008, as cited in EPA and Tetra Tech 2013, pg. 36) reviewed the crude oil spills that resulted from exploratory drilling in the Pacific, Atlantic, Alaska and Gulf of Mexico leases from 1971 to 2007. Of the approximately 14,000 wells drilled in these areas during this period, four resulted in spills of crude oil or condensate reaching the environment with spill sizes ranging from 0.8 bbl to 200 bbl (32 to 8,000 gal). During drilling of 35 exploratory wells in the Beaufort and Chukchi OCS region specifically, a total of 35 small spills occurred, with spill volumes totaling 26.7 bbl (1,068 gal) (MMS 2008, cited in EPA and Tetra Tech 2013, pg. 36). The volume of spills ranged from 0.01 gallons to 800 gallons, with a median spill size of 1 gallon. The majority of the small spills occurred in containment structures and did not reach the environment, while some occurred on platforms and facilities which were easily cleaned up. Of the 26.7 bbl spilled, approximately 24 bbl (or 90 percent) were recovered or cleaned-up (MMS, 2008, cited in EPA and Tetra Tech 2013, pg. 36).

Between 1984 and 2001 there were 28 oil spills requiring a response action in Cook Inlet (USFWS 2003, pg. 25). The spills were small and because of the turbulent water in the Inlet the oil dispersed quickly (Whitney 2002, cited in USFWS 2003, pg. 25).

5.2.2.2 Characteristics of a Small Spill

The size of a spill is categorized in NEPA documents to facilitate the enumeration, volume and risk of impact. Both BOEM (2012) and MMS (2003) considered two small spill sizes. BOEM (2012) considered small spills less than 50 bbl (2,100 gal), and greater than 50 bbl but less that 1,000 bbl. The MMS (2003) considered small spills less than 1,000 bbls and greater than or equal to 1,000 bbls. BOEM (2012) assumed that 1 to 3 spills of less than 50 bbl and 7 to 15 spills greater than 50 bbl but less than 1,000 bbl could happen in the Cook Inlet Planning Area; this included spills from platforms and pipelines. These small spills are more likely to occur during exploratory drilling and while they are not anticipated to affect the overall quality of Cook Inlet, they could affect ESA-listed species and their prey at low concentrations.

The oil from these small spills would need to encounter the species or their habitat (designated critical or otherwise) in order for adverse effects to ensue. In their analysis BOEM is assuming that all spills will occur in the coastal waters of Cook Inlet. However, the proposed action is authorized in federal waters of the territorial sea, not in coastal waters. All exploration would take place at least 3 nm from shore and 20 nm from sea lion rookeries. A spill would have to be of significant size and go unnoticed or occur at a times when responding to the spill would be difficult due to weather conditions in order for it to reach coastal areas.

As discussed previously most spills that occurred during exploration were infrequent, the amounts spilled were minor and the majority of the material was recovered. It is highly unlikely that a spill that occurs during routine exploration operations would go unnoticed. A significant amount of planning has been done to respond to oil spills in Alaska and in Cook Inlet. These plans minimize the potential for a spill to impact a sensitive area.

The Alaska Regional Response Team has developed a plan to respond to oil spills. Additionally, the ADEC has a Spill Prevention and Response Program which contains a Subarea Contingency Plan for Cook

Inlet. This plan lays out the process for responding to a spill from implementation of the Incident Command System to the prescriptive actions intended for protection of sensitive resources through the execution of Geographic Response Strategies.

Oil spills are inherent to oil and gas development. Large spills occur when vessels run a-ground (Exxon Valdez), when a well blowout happens (Deepwater Horizon) and when response time is complicated, delayed or lengthy. These catastrophic events are infrequent but the consequences can be devastating to the environment. A large spill is not expected to occur from the proposed action as discharges from production drilling are not authorized under the general permit. Instead, small spills are more likely to happen from the use of materials on deck or during fuel or fluid transfer from support vessels. The likelihood of these spills being of significant size, going unnoticed, or traveling the 3 nm to shore is remote. Therefore, there is a low likelihood that the nearshore environment, designated critical or other sensitive habitats will be affected.

5.2.2.3 Toxicity and Bioavailability of Polyaromatic Compounds

Petroleum hydrocarbons are toxic to aquatic organisms. The mechanisms of this toxicity and the components of petroleum causing it have been studied for decades. More recently the influence of ultraviolet radiation on specific PAHs and oil products has been shown to enhance the toxicity to aquatic organisms that are translucent, this includes early life stages of higher order organisms and invertebrates (Duesterloh et al. 2002; Barron et al. 2003; Wernersson 2003; Duesterloh and Shirley 2004; Barron et al. 2008). The photoenhanced toxicity of petroleum is thought to occur through activation of bioaccumulated residues; this is known as photosensitization (Little et al. 2000; Barron et al. 2008). Then ultraviolet radiation (UV) activates these accumulated compounds creating toxic intermediates which cause cell death and mortality (Barron et al. 2008, pg. 727). A study by Duesterloh et al. (2002) demonstrated that copepods can bioaccumulate PAH's from the water column. As a result, copepods can serve as a vector for bioaccumulation of toxins in higher trophic levels.

The discharge of oil and grease is not permitted under this general permit and any discharges containing these materials are treated through the use of an oil/water separator prior to discharge. Additionally, large oil spills are not anticipated during exploration. Therefore, the source of petroleum products may be the result of small petroleum spills which should not significantly impact copepods or other zooplankton on a landscape level.

5.2.3 Disturbance from Ships, Helicopters and Underwater Sound

Noise and other disturbances to the environment would occur during oil and gas exploration, development and production activities. Vessel traffic in the action area would include drill vessels, as well as support ships used to transport supplies and personnel (EPA 2012, pg. 4-229). Noise would be generated through boat and ship transit, helicopters, general machinery use and drilling. These sounds would be propagated into an environment that experiences noise and activity from other, ongoing activities. Table 9 presents the sound levels associated with various types of vessels and activities.

5.2.3.1 Vessels

The presence of these vessels within the action area could affect ESA-listed and candidate species through the generation of underwater or airborne noise and direct collision.

The number of boat trips anticipated by MMS (2003, pg. IV-56) over five years of exploration in Cook Inlet averages between 160 and 360 per year. Small vessels produce sounds of 145 to 170 decibels (dB) filling the frequency band below 1.7 Kilohertz (kHz) (Table 9). Underwater sound is measures in dB re 1 µPa. Aircraft emit sound at in air sound pressure levels of are measured in dB re 20 µPa.

5.2.3.2 Aircraft

Aircraft are also necessary support vehicles for transportation of workers and supplies. Most offshore air traffic associated with the oil industry relies on turbine helicopters flying along straight lines (NOAA 2003, pg. 28). Underwater sound resulting from passing aircraft is transient. Additionally, underwater sound levels from noise associated with aircraft depends on the type, altitude, aspect and strength of the source. Sound is normally reflected at angles exceeding 13 degrees without penetrating the water (Richardson 1995, cited in NMFS 2012, pg. 71). According to BOEM (2012, pg. 4-235) there may be up to three helicopter trips per week to each drilling vessel. This will increase the noise levels along the transit routes and at the drilling vessel.

The noise transmitted from helicopters and propeller driven aircraft concentrates at moderately low frequencies (Hubbard 1995, cited in BOEM 2012, pg. 3-73). A 4-engine P-3 Orion helicopter with multi-blade propellers has sound levels of 160-162 dB re 1 µPa in the 56 to 80 Hz band and 148 to 158 dB re 1 µPa in the 890 to 1,120 Hz band. Helicopters flying at 150 m (492 ft) altitude are anticipated to emit noises received at ground level of 80 to 84 dB re 20 µPa (Born et al. 1999, cited in BOEM 2012, pg. 4-347).

BOEM reports that fixed wing aircraft and helicopters produce noise levels of 156 to 175 dB re 20 µPa. A Twin Otter generates source levels of 147 to 150 dB re 1 µPa at the 82 Hz tone. The amount of sound transmitted through water depends on the flight angle from the vertical. When flying at angles greater than 13˚ from the vertical, the majority of incident sound is reflected without penetrating the water. The amount of underwater sound is greatest when the aircraft is overhead and at a 26˚ cone above the object.

5.2.3.3 Offshore Drilling

Jackup rigs will be used in LCI during all seasons. Unlike the Arctic drilling can take place 365 days/year 24 hours/day in Cook Inlet. Noise levels from jackup rigs would be similar or less that noise levels produced by drill ships because vibrating machinery is not in direct contact with the water (USFWS 2012, pg. 18). Noise from oil platforms (and presumably jackup rigs) is thought to be very weak due to the small surface area (the four legs) in contact with the water (Richardson 1995 cited in NMFS 2012, pg. 46). The primary contributors to underwater sound levels from Jackup rigs are generators and the drilling machinery itself (NOAA 2013, pg. 2-13).

The NMFS developed noise thresholds for pinnipeds to direct development of hazard areas. They determined that thresholds for Level A Harassment (injury) and Level B Harassment (disturbance) would be reached for pinnipeds under the following scenarios:

- Level B Harassment due to airborne noise: 100 dB re 20 µPa
- Level B Harassment due to underwater noise: 120 dB re 1 µPa (*rms*) for vibratory pile driving;
- Level A Harassment due to underwater noise: 190 dB re 1 µPa (*rms*)

The Level A harassment is potentially injurious to a marine mammal while Level B harassment may disturb a marine mammal potentially disrupting essential behaviors[10]. Underwater sound thresholds for seabirds exist for the marbled murrelet (*Brachyramphus marmoratus*) only. Thresholds were developed for pile driving in Puget Sound, Washington. Elevated high-energy underwater sound pressure levels (SPL) are generated by activities in the marine environments such as pile driving, seismic exploration, explosive detonation and sonar. The thresholds for marbled murrelets for injury due to impact pile driving and repetitive impulse underwater sounds[11] is:

- Auditory Injury threshold – 202 dB SEL;
- Non-auditory injury threshold – 208 dB SEL;
- Non-injurious hearing threshold shift zone out to 183 dB SEL;
- Potential behavioral effects zone out to 150 dB re 1 µPa (*rms*)

Underwater sound is generated through activities on the drilling vessels and the drilling itself. The sound levels produced by underwater drilling can be carried many kilometers from the source (Shell 2013). Shell (2013) presents a substantial amount of sound level threshold distance data for drilling activity in the Chukchi and Beaufort Seas. The distance that the sound levels traveled varied depending on the size of the pilot hole and where another vessel was in proximity to the drill ship (Table 1; Shell 2013). Sound pressure levels (SPLs) greater than 180 dB re 1 µPa (*rms)* were measured at a distance of less than 10 m from the drilling vessels; SPLs greater than 160 dB re 1 µPa (*rms*) were measures at 30 m and SPLs at 120 dB re 1 µPa (*rms*) reached distances of 1,500 to 13,000 m.

MAI (2011) measured underwater sound generated by the Spartan 151 Jack-up drill rig located in the Kitchen Lights Unit of upper Cook Inlet. The measurements were collected to demonstrate compliance with the Harassment Levels identified by NOAA within Cook Inlet beluga whale designated critical habitat. Measurements taken of the drill rig operation indicated that the primary sources of underwater sound were from the diesel engines, mud pump, ventilation fans and electrical generators. The loudest underwater sound levels were estimated at 137 dB re 1 µPa. Continuous sound levels exceeding the 190 dB re 1 µPa (Harassment Level A) was never measured. The non-continuous (less that 1 second) level exceeding 120 dB re 1 µPa was measured to a maximum range of 0.63 to 0.75 nm (1.2 to 1.4 km)

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[10] http://www.nmfs.noaa.gov/pr/glossary.htm#h

[11] http://www.wsdot.wa.gov/NR/rdonlyres/1A1AFC72-69F6-4C91-B479-F33D9F80F8ED/0/MAMU_EffectsThresholds.pdf

(MAI 2011, pg. 3). The level of 120 dB re 1 µPa (*rms*) for a continuous sound (the regulated threshold) was never measured (MAI 2011, pg. 29).

Once drilling commences the area around the drilling platform and from some distance can become ensonified potentially impacting marine mammal behavior. Sound pressure levels up to 190 to 160 dB re 1 µPa (*rm*s) dissipate quickly at less than 120 m; although these levels were never measured in Cook Inlet (MAI 2011). However, exploration drilling radiates underwater sound in excess of 120 dB re 1 µPa for many kilometers in the Arctic (Shell 2013). Blackwell and Greene (2002; cited in NOAA 2012, pg. 45) measured underwater sound produced at an oil platform and at six locations ranging in distance from 0.3 to 19 km. They found that the highest recorded sound level was 119 dB re 1 µPa at a distance of 1.2 km; consistent with the results for an impulsive sound from MAI (2011). NOAA (2003, pg. 22) cited another study that recorded noise from drilling so low as to be almost undetectable alongside the platform at sea states of three or above. The strongest tones were near 5 Hz and at the near-field locations were 119 to 127 dB re 1 µPa (Richardson et al. 1995 as cited in NMFS 2003, pg. 22).

Drilling does not produce high energy impact sound rather drill ships generate underwater sound at continuous low frequencies, primarily 20 to 1000 Hz (Greene 1987 cited in Johnson et al. 1990, pg. 136). Levels reaching 120 dB re 1 µPa (*rms*) were measured in pulses less than 1 second in Cook Inlet, continuous sound reaching Level B harassment was never measured.

5.2.3.4 Structures

Oil platforms and drilling vessels are man-made structures placed in the aquatic environment. They generate noise and artificial lighting which can obstruct wildlife affecting their movement and interactions with the natural environment. Night time lighting on offshore structures (including vessels) attracts seabirds and numerous mortalities have been documented (USFWS 2003, pg. 18).

5.2.4 Habitat Loss

The loss of habitat is attributable to the discharge of drilling fluids/muds (discussed previously) and the footprint of the drilling structure. A small amount of offshore habitat will be permanently disturbed. Jackup rigs are used in shallower waters while semisubmersibles and drill ships are used in deeper waters. A jackup rig consists of a drill rig attached to a barge. Once the barge reaches its desired location, support legs are attached and jacked downward to the sea floor. Once the legs reach the sea floor, the downward pressure of the jacking process lifts the barge out of the water. Semisubmersible rigs are mounted to a hull with adjustable ballast, allowing the hull to be raised or lowered within the water. In the drilling process, preparing the first few hundred feet of a well is called “spudding in.” This typically requires a large diameter pipe, called the conductor casing, to be hammered, jetted, or placed on the seafloor, depending on the composition of the substrate (EPA 1993 cited in USEPA and Tetra Tech 2013, pg. 11).

Physical habitat disturbance of a relatively small area will persist for the duration of the set up and drilling. The size of the area will depend on the type of drilling structure installed and the amount of drilling fluids/muds that buildup on the substrate in the near-field. According to BOEM (2012, pg. 4-160) the amount of bottom area disturbed ranges from 3.7 acres (1.5 ha) for each platform installed.

The amount of the disturbed area will be less than the 3.7 acres as platforms will not be installed for exploration. Some species will likely avoid the area while to vessel is in place and drilling operation is underway. This avoidance may result in a loss of habitat due to disturbance and the avoidance response. The degree to which this disruption reduces the ecological function of the habitat depends on the location of the well relative to designated critical habitat, sensitive resources areas and/or important habitat features (e.g. stellar sea lion haul outs).

5.3SPECIES EXPOSURE ANALYSIS

In order for a species to be affected it must be present in the action area at the time the action is underway. The list of species likely to be present in the action area and where warranted, their designated critical habitat is presented in Table 4. The following sections present the temporal and spatial overlap between the species and the activity to the degree that it can be predicted.

5.3.1 STELLER'S EIDER

A detailed description of the presence of this species in the action area is presented in USFWS 2003. The areas north and south of Deep Creek are important wintering grounds for Steller's eiders. Birds have been observed foraging and resting along the shallow shoal from Homer Spit to Ninilchik. Since 1997 observers on the eastern shore of Cook Inlet report large concentrations of birds wintering between Homer Spit and Clam Gulch during the months of December and March. Apparently, birds use the eastern shore of Cook Inlet when the western shore and upper Cook Inlet are iced in (USFWS 2003, pg. 23).

During winter Steller's eiders congregate in sheltered areas in lagoons or bays and along inlets and headlands (USFWS 2012, pg. 2). They remain in water less than 9.1 m (30 ft) deep and are generally found within 400 m (1200 ft) from shore (USFWS 2002, pg. 5). They feed by dabbling in shallow water for crustaceans and mollusks (USFWS 2002, pg. 2). In Cook Inlet this species is primarily found in State waters and given the habitat and feeding behavior it is not expected to be feeding within the action area 3 nm from shore. The 30 ft depth contour in presented in Figure 2 which shows where the species is likely to be feeding and loafing. Approximately 57.4 mi^2 (0.96 %) of the wintering habitat for this species falls within the action area; however, water depth in this area is greater than 30 ft. Given the sessile nature of the eiders prey, the distance between the foraging areas and any future discharges and the low bioconcentration of drilling fluids we do not expect bioaccumulation of pollutants associated with the discharges to be significant (Tables 15 and 16).

5.3.1.1 STELLER'S EIDER DESIGNATED CRITICAL HABITAT

Steller's eider critical habitat was not designated in Cook Inlet; therefore there will be no analysis of primary constituent elements for this species.

5.3.2 KITTLITZ'S MURRELET

The USFWS Listing Priority Assignment Form is a compilation of the most recent (as of 2010) information on this species (USFWS 2010). Much of the information used in this exposure profile was obtained from that document.

Kittlitz's murrelets are often found in proximity to tidewater glaciers, waters offshore of high-elevation glaciers and deglaciated coastal mountains (Day and Nigro 1999; Day et al 1999 cited in: USFWS 2010, pg. 5). Moreover, during the breeding season they are normally present in remote areas with floating brash ice.

This species is present in LCI during the breeding season even though the area has no tidewater glaciers or floating ice in summer. According to numerous authors cited in USFWS (2010, pg. 5) murrelets prefer shallow, turbid waters near established or advancing tidewater glaciers. The lower Inlet is influenced by glacial outflow from the four rivers that flow into it, and landlocked glaciers (Kuletz et al. 2011, pg. 86). Kachemak Bay receives up-welled water from the Gulf of Alaska carried by the ACC. Areas of upwelling tend to be highly productive providing nutrients to marine systems. The fish assemblages in Kachemak Bay are likely enhanced due to upwelling which improves the prey base for Kittlitz's murrelet.

During the breeding season Kittlitz's murrelets feed on high energy schooling fishes including the Pacific capelin, Pacific sand lance, Pacific herring (*Clupea pallasi*) and walleye pollock (Piatt et al. 1994; Day and Nigro 2000; Agness 2006; Kissling et al 2007 cited in: USFWS 2010, pg. 6). The presence of these various forage fish species is dependent upon their habitat preferences, Pacific capelin, Pacific sand lance and walleye Pollock are associated with shallow sills and strong currents (Arimitsu et al. 2008 cited in USFWS 2010, pg. 6). Kittlitz's murrelets forage at night bringing fish to chicks between dusk and dawn (Kaler et al. 2010; Naslund et al. 1994 both cited in: USFWS 2010, pg. 3).

Lower Cook Inlet is one of eight population centers for Kittlitz's murrelet during the breeding season, May through August (USFWS 2006, pg. 67) . Kendall and Alger (1998) conducted a population survey in LCI, Prince William Sound and southeastern Alaska. According to this survey birds are prevalent in LCI during summer with densities of 3,353 ± 1,718. However, no birds were observed during the winter surveys (February through March) of eastern LCI (Kendall and Agler 1998, pg. 54). Kittlitz's murrelets may winter in Kachemak Bay, they have been identified in this location in the past, however the authors didn't survey Kachemak Bay in this study (Kendall and Agler 1998, pg. 59)

Kuletz et al. (2011) surveyed this species in LCI. Their study area included approximately half of the Action Area, and Kachemak Bay. They estimated approximately 1600 birds in this location between 1996 and 1999. The authors also compared survey data collected in 1993 (June) and 1996 to 1999 (July to early August) from LCI, and from 2005 to 2007 in Kachemak Bay (July). During the later survey (2005 to 2007) an estimated population of 2,047 (± 1120) Kittlitz's murrelets were residing primarily in the inner Bay (Kuletz et al. 2011, pg. 85). The authors concluded that Kittlitz's murrelets "were most abundant in Kachemak Bay and along the eastern side of LCI, between the southern tip of the Kenai Peninsula and approximately 10 Km north of Anchor Point ".

In summary Kittlitz's murrelets are present in LCI for much of the year. They tend to congregate in shallow turbid waters influenced by glacial outflow. Large numbers of this species have been observed in Kachemak Bay an area that received upwelling from the ACC. They are solitary nesters feeding a single chick forage fish that are captured between dusk and dawn.

5.3.2.1 Kittlitz's Murrelet Designated Critical Habitat

Kittlitz's murrelet are listed as a candidate species under the ESA, therefore critical habitat has not been designated for this species.

5.3.3 Humpback Whale

Consistent with the presence information for fin whales the Kodiak Island/Shelikof Strait area is an important feeding area for humpback whales (NMFS 2003, pg. 17). However, humpback whales enter LCI and are known to feed in Kachemak Bay in late spring, summer and autumn prior to migrating from the Arctic in winter (NMFS 2003, pg. 24).

5.3.3.1 Humpback Whale Designated Critical Habitat

Critical Habitat has not been designated for the humpback whale; therefore there is no analysis of the primary constituent elements for this species.

5.3.4 Fin Whale

NMFS (2003) included the fin whale in their biological opinion for the Section 7 consultation on the Oil and Gas Sales 191 and 199 in Cook Inlet. Although there is no information to suggest that this species travels very far into Cook Inlet they do occur (in small numbers) in the Gulf of Alaska including Shelikof Strait (NMFS 2003, pg. 14). NMFS cites acoustic data collected between 1995 and 1999 which detected fin whales vocalizing in Alaskan waters year round with a peak in midwinter.

5.3.4.1Fin Whale Designated Critical Habitat

Critical Habitat has not been designated for the fin whale; therefore there is no analysis of the primary constituent elements for this species.

5.3.5 Cook Inlet Beluga Whales

Beluga whales are normally found in shallow coastal waters, frequently in water just deep enough to cover their bodies, however, they have also been observed in deep waters. Belugas appear to be well adapted to both in cold ocean water and warmer freshwater habitat such as estuaries and river basins[12], although the Cook Inlet population resides in this location year-round. Tracking studies demonstrate that belugas travel along the shorelines in Cook Inlet and focus their hunting efforts on rivers and fish-bearing streams that are used by salmonids for spawning[13].

Rugh (2010) used the data collected by NOAA and Alaska Department of Fish and Game for three periods of time 1978 to 1979, 1993 to 1997 and 1998 to 2008 to assess the species movement over time and document their range constriction. They determined that the whales have consistently moved north into upper Cook Inlet while continuing to use the Susitna River Delta. According to data collected from 1993 to 1997 beluga whales were using 51 percent of their original range and from 1998 to 2008 this use had dropped to 39 percent. This species has "essentially disappeared" from formerly used habitat in middle and LCI (Rugh et al. 2010, pg. 72).

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[12] http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/belugawhale.htm#description (accessed on 6/8/11)

[13] http://www.fakr.noaa.gov/protectedresources/whales/beluga/chabitat/phearingppt0210.pdf

The NMFS conducted a satellite tracking study of the movement of the Cook Inlet stock of beluga whales[14]. This was a multiyear study (1999-2003) designed to document the fall, winter and spring movements of tagged whales. The NMFS tracking study and other efforts have determined that over time beluga whales in Cook Inlet are now gathering in shallow areas near river mouths in the upper inlet near Anchorage (Rugh et al. 2000, pg. 6; Hobbs et al. 2005, pg. 335; Goetz et al. 2012, pg. 2).

Goetz et al (2012) tagged and monitored the movements of 25 beluga whales in Cook Inlet from 1999 to 2003. They monitored movement (n=14) and diving depth (n=11) including during the winter months. (Goetz et al. 2012). The authors concluded (2012, pg. 10) that overall belugas spend the majority of their time in upper Cook Inlet, north of East and West Foreland. Specifically, they observed whales foraging in Chickaloon Bay, Susitna Delta, Knik Arm, Turnagain Arm and Trading Bay. The whale's movements differed somewhat on a seasonal basis; from June to November they spent the most time in Knik Arm and Chickaloon Bay and in December to May they ventured farther south to the area above East and West Foreland. Overall beluga whales spent 0.2 percent of their time in LCI.

The whales preferred shallow inshore waters throughout the year, but the presence of sea ice between December and May may keep them from accessing the coastal areas (Goetz et al. 2012, pg. iii). Belugas prefer deeper water (greater than 25m; 75 ft) from December to May and shallower water (less than 25 m; 75 ft) in June to November (Goetz et al. 2012, pg. 24). According to the data collected the whales dove to deeper depths in the North Foreland and in LCI, while the longest mean dive durations occurred in the North Foreland in Knik Arm (Goetz et al. 2012, pg. 18). However, the authors would have expected the whales to dive deeper in LCI considering the bathymetry (Goetz et al. 2012, pg. 24). The mean diving depth of belugas whales in LCI ranged from 1.8 ± 3.3 m (6 ± 11 ft) from June to November to 10.2 ± 13.7 m (33 ± 43 ft) from May to December, with and overall mean of 7.2 ± 11.9 m (24 ± 39 ft) (Goetz et al. 2012, pg. 13).

Hobbs et al. (2005) tracked the movements of 14 belugas using satellite telemetry between July and March between 2000 and 2003 (Figure 7). They determined that the whales remained in upper Cook Inlet between late autumn and moved to the mid-Inlet offshore waters during the winter. In the summer and early fall the whales concentrated at river mouths or bays to take advantage of eulachon (*Thaleichthys pacificus*) and Pacific salmon runs (Hobbs et al. 2005, pg. 336). The whales moved from 7 miles to 19 miles (11 km to 30 km) on a daily basis. The home range size varied depending on the season with the smallest in August (982 km^2; 379 miles) increasing to a maximum in winter (5,000 km^2; 1,930 miles).

In summary, beluga whales are primarily found in upper Cook Inlet, and they spend a small percentage of their time in the lower Inlet. Previously used habitats in mid and LCI are rarely used. They prefer shallow inshore water and tend to travel along the shorelines in Cook Inlet and focus their hunting efforts on rivers and fish-bearing streams. The whales have a larger home range in winter than summer and dive to deeper depths in LCI.

[14] http://www.afsc.noaa.gov/nmml/cetacean/belugatags/ (accessed on 6/8/11)

5.3.5.1 Cook Inlet Beluga Whale Designated Critical Habitat

Cook Inlet beluga whale critical habitat is separated into two distinct areas. Area 1 is in north Cook Inlet and includes Knik Arm and Anchorage. Area 2 is larger and extends south into the Action Area. Beluga whales use Area 2 primarily for dispersed fall and winter feeding and transit areas [FR 76 20180]. There are fewer whales in Area 2 and they tend to be more dispersed. A small portion of critical habitat (approximately 82 km^2) is within that portion of the action area where oil and gas exploration are permitted. The remainder of Area 2 critical habitat is located along the nearshore in State waters or in the northern part of the action area where vessel and aircraft traffic are anticipated to travel to and from the drilling platforms (Figure 7).

According to FR 76 20202 the PCEs of beluga what critical habitat include:

PCE #1: Space for individual and population growth.

PCE #2: Food, water, air, light, mineral, or other nutritional or physiological requirements.

PCE#3: Cover or shelter.

PCE #4: Sites for breeding, reproduction, rearing of offspring.

PCE #5: Habitats that are protected from disturbance or are representative of the historic, geographical and ecological distribution of the species.

More specifically the biological features essential to the conservation of the species include:

1) Intertidal and subtidal water of Cook Inlet with depths less than 9.1 m (30 ft) mean lower low water and within 5 miles (8 km) of high and medium flow anadromous fish streams.

2) Primary prey species consisting of four species of Pacific salmon (Chinook, sockeye, chum, and Coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod and yellowfin sole.

3) Waters free of toxins or other agents of a type and amount harmful to Cook Inlet Beluga Whale.

4) Unrestricted passage within or between the critical habitat areas.

5) Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet Beluga Whale.

5.3.6 Northern Sea Otter

As presented in Figure 2 the Southwest DPS of the northern sea otter is present along the west shore of Cook Inlet south of Chinitna Point and in Kachemak Bay, neither of these locations is within the Action Area; this is according to NOAA's Environmental Sensitivity Index (ESI). The ESI maps provide the resources at risk if an oil spill were to occur nearby. Although the species itself does not occur in the action Area, it is possible that territorial adult male otters may swim across Cook Inlet through the action area in search of more productive foraging areas (74 FR 51988, pg. 51998). According to K. Klein (*in Litt*, March 2013) sea otters “are most common along the shore and in shallow water, but can swim long distances and have been recorded in the middle if LCI.

The Final Rule (74 FR 51988) designating critical habitat for the southwest DPS of the northern sea otter provides a detailed summary of how this species utilizes its habitat. The Final Rule also breaks down the essential habitat features and discusses their juxtaposition with and use by otters. This summary was instrumental in providing EPA with the information necessary to characterize exposure of otters to the proposed action and interrelated and interdependent actions.

Habitat use is directly related to life stage and sex. Breeding males are not able to defend a large territory, it is thought to be smaller than the females home range (less that 5 to 10 miles), but they will move greater distances to reach more productive feeding grounds (74 FR 51988, pg. 51998).

Northern sea otters are a nearshore species. According to unpublished survey data collected on 811 otters by USFWS and reported in the Final Rule (74 FR 51988, pg. 51998) the median distance to shore was 10 m (33 ft), and 90 percent of the animals were observed within 100 m (328 ft). The remaining otters were observed (using aerial surveys) utilizing sheltered bays and coves. Sea otters rest in kelp forests and these are generally located in water less than 20 m (66 ft) in depth (O’Clair and Lindstrom 2000, cited in 74 FR 51988, pg. 51998).

Sea otters feed on sessile or slow moving invertebrates that inhabit rocky and soft sediment between the high intertidal zones to depths in excess of 100 m (328 ft). However preferred foraging is generally at depths of 40 m (131 ft) or ranges from 40 to 80 m (131 to 262 ft) (Reidman and Estes, 1990; Bodkin et al 2004, both as cited in 74 FR 51988 pg. 51998).

During the breeding season headlands, coves and bays are preferred resting habitat likely because they are sheltered from wind and waves and protected from marine predators (Figure 2). While foraging sea otters dives in water less that 20 m (66 ft) in depth which is likely consistent with the use of these sheltered habitats; apparently use of this water depth is consistent regardless of the location (Bodkin, 2004 as cited in 74 FR 51988, pg. 51999) .

In summary, sea otters are nearshore obligates and utilize habitats within 100 m of shore and in water depths up to 80 m (260 ft) but more generally 20 to 40 m (66 to 131 ft). Territories vary and depend on sex, with females ranging from 5 to 10 miles of contiguous coastline and males defending smaller territories but ranging farther when searching for more productive foraging areas. EPA would expect direct exposure primarily to discharges from exploration vessels if these discharges were to move to the nearshore. However, sea otters have been recorded in the middle of Cook Inlet, and therefore it is possible that they will be in the action area for the time it takes them to traverse the Inlet and so they may encounter discharges for a short time.

5.3.6.1 Southwest DPS of the Northern Sea Otter Critical Habitat

The primary constituent elements of sea otter critical habitat include:

1) Shallow, rocky areas where marine predators are less likely to forage, which are waters less than 2 m (6.6 ft) in depth.

2) Nearshore waters that may provide protection or escape from marine predators, which are those within 100 m (328 ft).

3) Kelp forests that provide protection from marine predators, which occur in waters less that 20 m (65.5 ft) in depth, and

4) Prey resources within the areas identified by PCE's 1, 2, and 3 that are present in sufficient quantity and quality to support the energetic requirements of the species.

The nearshore marine areas within the range described in the summary above that are within 100 m (328 ft) from the mean high tide line and to 66 ft (20m) in depth contain the necessary PCEs for protection of marine predators. This protection is essential to the conservation of this DPS.

5.3.7 Steller Sea Lions

Steller Sea lions and their designated critical habitat are present in LCI. Designated critical habitat was developed for this species in 1993, and included all major rookeries and haulouts extending 0.9 km (3,000 ft) landward and vertically (air zone) from sea level, and a 20 nm water-ward aquatic zone (50 CFR 226.202). There are rookies on Sugarloaf and other outer islands. Haulouts are present on the southwest side of the Kenai Peninsula.

Steller sea lions practice strong site fidelity particularly to rookeries. While rookeries are used by adults during the breeding season haul outs may be used by all age classes throughout the year (NMFS 2008, pg. I-19). This species also uses traditional sites which are areas where they rest on the surface while tightly packed together, these sites are not well known. Neither rookeries nor haul outs are within the action area, designated critical habitat is, albeit only a small portion (Figure 3).

Since critical habitat was designated a great deal of information has been developed to describe movement and foraging behavior of this species. The reduction in numbers and the mystery surrounding the reason for the status of this species was likely the catalyst for this research. Researchers have used telemetry to document movement of adult females and juveniles. This telemetry demonstrated that trip duration and distance fluctuate seasonally but seldom exceed more than 20 hours and 20 km, respectively (NMFS 2008, pg. I-20).

Models have been developed to predict how movement and behavior of Steller sea lions is influenced by the biotic and abiotic characteristics of the marine environment. Gregr and Trites (2008) developed a deductive model which they used to predict the distribution of sea lions from a central place to foraging locations. They incorporated what is known about foraging behavior and bathymetry, haulout and rookery locations and ocean climate to develop hypotheses on habitat accessibility and suitability. Gregr and Trites (2008) used the model to predict where sea lions would forage based on the physical and biological input factors and then spatially compared these predictions to designated critical habitat. They used the sea lion presence data that has been collected since critical habitat was designated to validate the model and compared the spatial distribution of these observations to critical habitat and to their model predictions. They concluded that their model was more effective at predicting the distribution of the sea lions as it captured significantly more observations than critical habitat. They also demonstrated that the 150 to 200 m depth range is important to sea lions, which suggests that sea lions may forage far from the central place (haulout). During the breeding season females and juveniles remain close to the rookeries while foraging. Females with pups must forage close by so that they can return at regular intervals to feed their young.

In summary foraging behavior and habitat use depend on both sex and life stage. Two types of distribution of sea lions has emerged from the data collected on this species: 1) females with pups, pups and juveniles remain close to rookeries and haul out sites and range less than 20 km from these sites, and 2) males, females and juveniles after the breeding season will exceed 20 km but rarely 37 km (20 nm). Finally, foraging trip duration rarely exceeds 20 hours.

5.3.7.1 Steller Sea Lion Critical Habitat

The 1993 Final Rule (58 FR 45269) for the designation of critical habitat identifies essential habitat for the Steller sea lion. Essential habitat includes the physical and biological habitat features that support reproduction, foraging, rest and refuge. These features are essential to the conservation of the species and include terrestrial and aquatic areas.

Rookeries and haulouts are the terrestrial habitat features that support reproduction, rest and refuge. These areas are well documented and rarely change, as their suitability for meeting the biological needs of the species depends on the location relative to substrate, exposure to wind and waves, human disturbance and proximity to prey resources (Mate 1973 as cited in 58 FR 45269). There are no rookeries or haulouts in the action area; the nearest rookery is located on Sugarloaf Island which is in proximity to the Shelikof Strait foraging area.

5.4 Species Response Analysis

Effects of the action can be direct, indirect or result from interrelated and/or interdependent actions. Direct effects are effects that occur as a direct result of the project, whereas indirect effects can occur later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (50 CFR 402.02). Direct and indirect effects can occur as a result of interrelated and interdependent actions.

EPA relied on the primary literature, the Fact Sheet for the reissuance of the general permit for oil and gas exploration facilities in Cook Inlet, and following documents in assessing potential effects on ESA-listed and candidate species within the action area:

1) Environmental Assessment: Reissuance of a NPDES General Permit for Oil and Gas Exploration, Development and Production Facilities Located in State and federal waters in Cook Inlet, Alaska (EPA 2006).

2) The Outer Continental Shelf Oil and Gas Leasing Program: 2012 – 2017 Final Programmatic Environmental Impact Statement (BOEM 2012).

3) The Final Environmental Impact Statement for the Cook Inlet Planning Area Oil and Gas Lease Sales 191 and 199 (Malme et al. 1985; MMS 2003).

4) The Biological Evaluation for the Cook Inlet NPDES Permit prepared by Tetra Tech, Inc for EPA Region 10 (Tetra Tech 2006).

5) The ODCE for Cook Inlet (EPA and Tetra Tech, 2013).

6) Biological Opinions by the Services (NMFS 2003; USFWS 2003; NMFS 2012).

7) Environmental Impact Statement (EIS) on the effects of oil and gas activities in the Arctic Ocean (NOAA 2013).

The potential effects of activities and discharges authorized under the NPDES general permit on listed, proposed and candidate species are discussed in the following sections. In addition to the potential effects from permitted discharges, interrelated actions including the use of support vessels and the presence of offshore drilling structures is considered. The direct and indirect effects of these actions include: 1) the generation of in-air and underwater sound from vessels and helicopters, 2) direct strikes from vessels associated with the facilities and through attraction to offshore lighting, 3) the potential for oil spills, and 4) habitat disturbance from discharges, coring and drilling.

The following sections contain an integration of: 1) the stressors anticipated to result from the proposed action, 2) exposure of the species, their designated critical habitat and prey, and 3) the magnitude of the threats identified in the environmental baseline which influence the resiliency of the species to respond to the stressor.

5.4.1 Steller's Eider

Steller's Eiders are located in the nearshore waters of the east side of LCI, south of Ninilchik and in Kachemak Bay during winter months (Figure 8). Additionally, a small number (approximately 100 birds) is known to remain in Kachemak Bay in summer (USFWS 2003, pg. 8). Although this species has a preference for nearshore habitat they have been observed over 10 and 30 km from shore in Kuskokwim Bay and in the Bering Sea, respectively.

During winter Steller's eiders congregate in sheltered areas in lagoons or bays and along inlets and headlands (USFWS 2012, pg. 2). They remain in water less than 9.1 m (30 ft) deep and are generally found within 400 m (1,200 ft) from shore (USFWS 2002, pg. 5). They feed by dabbling in shallow water for crustaceans and mollusks (USFWS 2002, pg. 2). This species utilizes State waters and given the habitat preferences and feeding behavior it is not expected to occur for a significant amount of time within the action area 3 nm from shore.

As depicted in Figure 8 there is overlap between the wintering area for Steller's eider and the action area. However, the nearshore 9.1 m (30 ft) where birds will likely be feeding and loafing for the majority of the time is outside of the action area. It's possible that some birds will be found within the action area, however they are not expected to spend a significant amount of time there and they would not be able to access prey by dabbling in water in excess of 18 m (60 ft).

5.4.1.1 Direct Discharges

Discharges covered under this general permit are not authorized within State waters. Therefore, the 100 m (328 ft) mixing zone must not overlap with State waters. The majority of the Steller's eider wintering area is within state waters and so direct exposure of birds to discharges is highly unlikely. Because these birds spend the majority of their time in the nearshore any exposure to elevated pollutant levels within the vicinity of the drilling vessel would be short term.

Additionally, because of the current patterns (to the southwest) and rapid deposition (50 m to 100 m; 164 to 326 ft) from the discharge, point drilling fluids and cuttings are not anticipated to build up in the nearshore where the Steller's eiders will be foraging. Finally, because the bioavailability of pollutants in drilling fluids has been demonstrated to be low (Crecelius et al. 2007; (Kramer et al 1980; Trefry et al 1986; Leuterman et al. 1997; Trefrey and Smith 2003, all cited in Neff 2008) they are not anticipated to build up in the prey species (Table 16 and 17). Some of the metals that partition out of the drilling muds into the water column may be accumulated by mollusks and then consumed by eider, however given the significant amount of mixing and dilution in LCI due to tides and current (see Section 5.2.1.2), the amount accumulated from drilling waste and subsequently consumed by the birds although unknown, is expected to be minimal. The mollusk data presented in Table 16 show that arsenic and cadmium have accumulated in these species although at low (< 5 mg/kg) levels. While a food web model has not been constructed for this species to predict toxicity, ATSDR reviewed the tissue levels in light of human health effects and determined them to be below levels of concern.

Exploration activities conducted within the action area would result in the authorized discharge of chemicals to open waters. These discharges could include various forms of waste, on–deck spills and cleaning products. They would be lower volumes than the drilling fluids described above, and are expected to dissipate within the extent of the mixing zone (100 m, 328 ft). There may have some short-term adverse effects to the invertebrates/plankton communities found within the mixing zone, but are not expected to have wide-spread or long-lasting effects, as these discharges are not expected to contain any pollutants that bioaccumulate or persist in the environment (Section 6.1 in EPA and Tetra Tech, 2013). Discharges with a visible sheen are treated prior to discharge to remove petroleum products. Federal mixing zones will not enter State waters, additionally drilling in not permitted in depths less that 33 ft (10 m).

Spatial restriction on discharge locations should also minimize the exposure and effects to Steller's eiders and their prey. There are no discharges permitted within 4,000 m of a coastal marsh, river delta, river mouth, designated Area Meriting Special Attention, State game refuge, State game sanctuary, State critical habitat area, or National Park.

Therefore, because: 1) authorized discharges will not enter State waters, 3) treatment requirements and effluent limitations will reduce the chemicals in the discharges, 3) discharge of petroleum products is prohibited 3) tides and currents result in significant dilution and transport of chemicals out of Cook Inlet, 4) trace metals have not bioaccumulated significantly in the Steller's eider prey, and 5) drilling fluids and mud accumulation will not occur within the wintering/feeding area of Steller's eiders causing a reduction in prey, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable direct effects to Steller's eider or indirect effects to their prey.

5.4.1.2 Habitat Loss

As presented in Figure 8 there is a small portion of Steller's eider wintering habitat within federal water with the majority of wintering habitat in State waters and in Kachemak Bay where drilling is not allowed. The small portion of wintering habitat that overlaps with federal waters is located in water greater than 60 ft deep so it is unlikely that eiders would be feeding in this area.

Therefore, because: 1) only a small portion of the wintering habitat is present within federal waters, 2) all the habitat federal waters is deeper than the preferred foraging depths, and 3) drilling fluids and mud accumulation will not occur within the wintering/feeding area of Steller's eiders causing a reduction in prey, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable effects to Steller's eider habitat.

5.4.1.3 Oil Spills

There is an extremely low likelihood of a large oil spill resulting from exploration during routine operations (see Section 5.2.2). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is possible that Steller's eider will be in the vicinity of a drilling vessel during a spill event. However, the spill is likely to be small and the response rapid. Additionally, USFWS (2003, pg. 30) conclude in their biological opinion on 3-D seismic surveys in LCI that "the probability of a spill of such magnitude that would injure Steller's eiders or their habitat is small"

Therefore, because: 1) few spills result from exploration activities, 2) the spills are generally considered small, 3) there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, 4) drilling vessels will be located farther than 3 nm from shore due to restrictions on discharges in State water which further minimizes exposure of Steller's eider to oil spills, EPA concludes that accidental spill that occur during oil and gas exploration will not result in measurable effects to Steller's eider habitat.

5.4.1.4 Disturbance from Ships, Helicopters and Underwater sound

Wintering Steller's eider could be disturbed by low flying aircraft, vessel traffic and noise and movement associated with drilling vessels. Repeated disturbance of concentrations of wintering birds could elevate energy expenditure due to increased movement or stress, potentially resulting in reduced over-winter survival. Birds could also abandon foraging areas creating increased foraging pressure in areas receiving greater use by displaced birds. There is also a possibility that individual birds could be killed or injured due to collisions with lighted drilling vessels.

Larned (2006) conducted a survey of wintering Steller's eider and determined that the birds congregated in the nearshore (shoreward of the 20 m isobath) from Anchor Point to 25 km (15.5 m) north of Ninilchik and the nearshore from Homer Spit to Anchor Point. The birds also use western Cook Inlet in southern Kamishak Bay from the Douglas River to Bruin Bay; they are primarily found in bays and coves. Drilling vessels will be located at least 3 nm from the nearshore; therefore most of the activity (boat and helicopter traffic) will take place far from the concentrations of these birds. There will be some disturbance however, for those craft that go between the airport in Homer and ports in Homer, Anchor Point and Ninilchik.

In order to avoid and minimize the disturbance of Steller's eiders all vessels will be required to maintain a 300 m (984 ft) buffer distance from eiders during winter when birds are resident in LCI. Additionally, aircraft supporting drilling operations will avoid operating below 1,500 ft above sea level over the wintering habitat of Steller's eider.

Underwater sound is generated through activities on the drilling vessels and the drilling itself. The sound levels produced by underwater drilling can be carried many kilometers from the source. Shell 2013 presents a substantial amount of sound level threshold distance data for drilling activity in the Chukchi and Beaufort Seas. The distance that the sound levels traveled varied depending on the size of the pilot hole and where another vessel was in proximity to the drill ship (Table 1 Shell 2013). MAI 2011 demonstrated that sound generated by a Jack-up rig in upper Cook Inlet did not emit continuous sound in excess of the marine mammal thresholds (Level A and B) nor the thresholds established for marbled murrelet. The 120 dB re 1 µPa was measured for an impulsive sound (less than 1 second).

Disturbance levels don't exist for eiders levels however they have been established for the marbled murrelet and marine mammals (Section 5.2.3). The potential behavioral effects zone out to 150 dB re 1 µPa (rms) would exist between <10 m and 25 km depending on the proximity of other vessels (Shell 2013, Table 1). The effect threshold for murrelets is based on high impact sound and drilling does not produce this type of waveform. So it is difficult to speculate on the response of eiders to drilling noise as is relates to pile driving benchmarks. Birds that are present on their wintering grounds will likely be aware of the sound generated by drilling when they are feeding and if the drill rig is within 5 km (3 nm) they may encounter sound levels in excess of the disturbance threshold for murrelets. However, EPA does not expect that the level of underwater sound generated by drilling vessels in federal waters will measurably affect essential behaviors of Steller's eiders in the nearshore.

5.4.2 Kittlitz's Murrelet

This species is prevalent in LCI during the breeding season but their winter distribution in the Inlet is less certain (Section 6.3.2). They prefer shallow turbid waters near advancing or established tidewater glaciers. Kittlitz's murrelets are found in a significant portion of the action area and in significant numbers (Figure 8). These birds are most abundant in Kachemak Bay, primarily in the inner bay and along the eastern side of LCI, between the tip of the Kenai Peninsula and approximately 6 miles north of Anchor Point (Kuletz et al. 2011, pg. 92); these areas are outside of the exploration action area.

5.4.2.1 Direct Discharges

Exploration activities conducted within the action area would result in the authorized discharge of chemicals to open waters (as discussed in Section 5.2.1 and 3.0 of the EPA and Tetra Tech (2013)). These discharges could include various forms of waste, on–deck spills and cleaning products. These discharges would be of lower volumes than the drilling fluids described previously, and are expected to dissipate within the extent of the mixing zone (100 m, 328 ft). There may be short-term adverse effects to the invertebrates/plankton communities found within the mixing zone from exposure to the discharges. However, these effects are not expected to have wide-spread or long-lasting impacts, as the discharges are not expected to contain pollutants that bioaccumulate or persist in the environment.

It is unlikely that murrelets will encounter the direct discharges unless they are in close proximity (<100 m) to the drilling vessels. Given that Kachemak Bay and the east side of LCI are "foraging hot spots" we do not anticipate that the birds will be prevalent in federal waters for an extended period of time. Kittlitz's murrelets feed near tidewater glaciers, among icebergs and outflows of glacial streams (more prevalent in LCI) (USFWS 2006, pg. 68). Kuletz et al (2001) did observe unidentified murrelets and Kittlitz's murrelet in Kachemak Bay, Tuxedni Bay and the southern tip of Kalgin Island near the border of the action area (Kuletz et al. 2011, Figure 3). Therefore, it is likely that murrelets could be present within federal waters; in winter they are presumed to be pelagic (USFWS 2012, pg. 45).

During the breeding season Kittlitz's murrelet prey on Pacific capelin, pacific sand lance, Pacific herring and walleye Pollock, all species are prevalent and some spawn in LCI (USFWS 2012, pg. 45). There are metals tissue data (whole body wet weight) for these prey species collected in Cook Inlet (Table 16). According to these data metals are not bioaccumulating to any great degree (most less than 1 mg/kg ww) in the tissues of prey species. ATSDR (2009) conducted an evaluation of seafood data collected from Cook Inlet near native villages and while these data are not entirely pertinent to ESA-listed and candidate species the results can be used to inform this analysis. Fish tissues collected for analysis to evaluate risk to human health are processed differently, in general only tissues (i.e. fillet) consumed by humans are analyzed, while whole body tissue data are analyzed for wildlife (Table 16). ATSDR concluded that arsenic, barium (not measured by ADEC for wildlife), cadmium, chromium, selenium and methylmercury were not present at level which would be a risk to human health. There was some concern about blood lead levels in children, however; lead when it was measured was below 0.055 mg/kg (ww). Therefore, based on the available data (and in the absence of a food web model), metals in fish and invertebrates do not appear to be at levels that would adversely affect Kittlitz's murrelet.

Therefore, because: 1) murrelets are not expected to be in close proximity to drilling vessels and within the mixing zone because their primary feeding areas are not within the action area, 2) treatment requirements and effluent limitations will reduce the chemicals in the discharges, 3) metals do not appear to be bioaccumulating in the Kittlitz's murrelet prey, 4) drilling fluids and mud accumulation will not occur within the primary feeding areas of Kittlitz's murrelets causing a reduction in prey, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable direct effects to Kittlitz's murrelets or indirect effects to their prey.

5.4.2.2 Oil Spills

There is an extremely low likelihood of a large oils spill resulting from exploration during routine operations (see Section 5.2.2). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have happened in the past during exploration but the volumes have been low and recovery successful. It is possible that Kittlitz's murrelets will be in the vicinity of a drilling vessel during a spill event but there is a low likelihood of exposure because spills are likely to be small and the response rapid.

Therefore, because: 1) few spills result from exploration activities, 2) the spills are generally considered small, 3) there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, 4) drilling vessels will be located farther than 3 miles from shore due to restrictions on discharges in State water which further minimizes exposure of Kittlitz's murrelets on their primary feeding areas, EPA concludes that an accidental spill that occur during oil and gas exploration will not result in measurable effects to Kittlitz's murrelets.

5.4.2.3 Disturbance from Vessels, Aircraft and Underwater Sound

BOEM reports that up to 12 wells may be drilled within the action area and that support vessels may make from one to three trips per week to support these operations. The level of disturbance over the entire action area is considered minor given the size of the action area (2,970 mi^2), the number of wells that may be drilled and the frequency of the support vessels (including helicopters) trips.

Kittlitz's murrelets preferred foraging areas are within the vicinity of tidewater glaciers and the outflow of glacial streams and within embayments, as discussed previously. Therefore, we would not expect these birds to be foraging within the vicinity of drill rigs in federal waters. In the event that a murrelet is within the action area in the vicinity of a support vessel we would expect that any disturbance to the bird would be temporary (the time it takes the vessels to move out of the area). Murrelets respond to vessel operation by diving, swimming away or leaving a foraging area (USFWS 2010, pg. 66). Once the vessel moves off and the disturbance (in air noise) dissipates the murrelet(s) would likely resume normal behaviors (USFWS 2010, pg. 66) .

Underwater sound is generated through activities on the drilling vessels and the drilling itself. The sound produced by underwater drilling can be carried many kilometers from the source (Shell 2013). Shell 2013 presents a substantial amount of sound level threshold distance data for drilling activity in the Chukchi and Beaufort Seas. The distance that the sound levels traveled varied depending on the size of the pilot hole and whether another vessel was in proximity to the drill ship (Table 1 Shell 2013). MAI 2011 demonstrated that sound generated by a Jack-up rig in upper Cook Inlet did not emit continuous sound in excess of the marine mammal thresholds (Level A and B) nor the thresholds established for marbled murrelet. The 120 dB re 1 µPa (*rms*) was measured for an impulsive sound (less than 1 second).

While disturbance levels don't exist for Kittlitz' murrelets levels have been established for the marbled murrelet and marine mammals (Section 5.2.3). The potential behavioral effects zone is out to 150 dB re 1 µPa (*rms*) and this level was never measured in Cook Inlet. According to MAI (2011) the continuous sound level exceeding the 190 dB re 1 µPa (Harassment Level A) was never measured. The non-continuous (less that 1 second) level exceeding 120 dB re 1 µPa was measured to a maximum range of 0.63 to 0.75 nm (1.2 to 1.4 km) (MAI 2011, pg. 3). The level of 120 dB re 1 µPa (*rms*) for a continuous sound (the regulated threshold) was never measured (MAI 2011, pg. 29).

The effect threshold for murrelets is based on high impact sound and drilling does not produce this type of waveform. So it is difficult to speculate on the response of murrelets to drilling noise as is relates to pile driving benchmarks. Birds that are present in their preferred feeding areas in Kachemak Bay will likely be aware of the sound generated by drilling when they are feeding, however it is unlikely that they will encounter sound levels in excess of the disturbance threshold necessary to disrupt essential feeding behaviors. This is particularly important during the breeding season when birds are feeding chicks and disruption of feeding could result in a missed meal for a chick.

In their 2010 Biological Opinion on the U.S. Navy's Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex Extensions in Washington State the Service evaluated the use of sonar and its effects on the marbled murrelet (USFWS 2010). They concluded that unless there was a perceived risk of predation (birds being approached by persons in boats or on foot) that marbled murrelets would habituate to sonar and countermeasure sound fields (> 150 dB_{rms}). Their review of the literature led the Service to the "conclusion that the perceived risk of predation is fundamental to inferring fitness effects on individual murrelets from underwater sound fields > 150 dB_{rms}". Stimuli associated with sonar (and likely drilling noise) was not linked with a direct anthropogenic threat to the birds and therefore the Service assumed "that is unlikely that murrelets will exhibit any of the …behaviors that may lead to termination of a foraging bout (i.e. individuals will likely perceive the sound wave as non-threatening and continue to forage" (USFWS 2010, pg. 92).

Disturbance from vessel traffic is not expected to result in a significant impact to Kittlitz's murrelets due to the low likelihood of the birds encountering the vessels and the short duration of the potential exposure. Empirical data collected in Cook Inlet using Jack-up rigs indicates that sound levels determined to result in a significant impairment of essential behaviors is unlikely, therefore EPA concludes that disturbance from vessel traffic and exposure to underwater sound generated by the interrelated activities associated with oil and gas exploration are not likely to result in measurable effects to the Kittlitz's murrelet.

5.4.2.4 Habitat Loss

The Kittlitz's murrelet it is currently a candidate for listing on the ESA. As such, critical habitat has not been designated for this species. Habitats and preferred foraging areas used by the murrelet are also not are not within the action area. Discharges while ongoing through exploration are rapidly diluted and materials in them carried out of LCI through Shelikof Strait. Trace metals and metalloids in the drilling fluids/muds discharged during operation do not appear to be bioaccumulating in the murrelet food web.

Kittlitz's murrelets have been observed in the action area (Figure 8) and the birds use LCI at a minimum during the breeding season, however essential behaviors such as breeding, feeding and sheltering are not likely depended on habitat in the federal waters 3 nm offshore in LCI. Therefore, EPA concludes that effects to Kittlitz's murrelet habitat from reissuance of the Cook Inlet Oil and Gas Exploration General Permit will be insignificant.

5.4.3 Humpback Whale

The range of the humpback whale in LCI overlaps with the Action Area in the vicinity of Kachemak Bay (Figure 8).

5.4.3.1 Direct Discharges

Pollutants in direct discharges can impact humpback whales through dermal absorption or ingestions via water or indirectly through prey. However, as previously discussed discharges from drilling vessels will be quickly diluted due to the hydrodynamic of LCI. Furthermore, it is highly unlikely that humpback whales will remain in the near field (within 100 m) vicinity of drilling vessels to be exposed for any length of time to elevated concentrations of metals in drilling fluids and cuttings or pollutants in other discharges.

As described previously, the other permitted discharges undergo various types of treatment and prohibit the discharge of oil (section 2.4.3). The bioavailability of pollutants in barite used a weighing agent in drilling fluids has been demonstrated to be low (Crecelius et al. 2007; (Kramer et al 1980; Trefry et al 1986; Leuterman et al. 1997; Trefrey and Smith 2003, all cited in Neff 2008. Empirical data (albeit limited) consisting of fish and invertebrate tissues analyzed for metals and metalloids suggest that bioaccumulation is not occurring to a great extent, as the concentrations are below 1 mg/kg (EPA 2003; Table 15-17).

There may be some toxicity associated with the discharges that will reduce the population of zooplankton in the vicinity of the drilling vessel. However, this affect is anticipated to be localized due to the low toxicity associated with the drilling fluids (See Section 6.1 in EPA and Tetra Tech (2013)), treatment of other discharges and restriction on the release of oil. Therefore, the discharges are not anticipated to significantly reduce the population of organisms lower on the food chain that are prey to the fish species consumed by humpback whales.

Therefore, because: 1) exposure of whales is expected to be short term if at all, 2) treatment requirements and effluent limitations will reduce the chemicals in the discharges, 3) tides and currents result in significant dilution and transport of chemicals out of Cook Inlet, 4) discharges are not permitted in Kachemak Bay where whales are generally found, and 5) pollutants in the discharges do not appear to be nor are expected to bioaccumulate in prey, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable direct effects to Humpback whales or indirect effects to their prey.

5.4.3.2 Oil Spills

There is an extremely low likelihood of a large oils spill resulting from exploration during routine operations (see Section 5.2.2. Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is possible that humpback whales will be in the vicinity of a drilling vessel during a spill event. However, based on history the spill is likely to be small and the whales are not anticipated to be in such close proximity to the drilling vessel during a response action.

Therefore, because: 1) few spills result from exploration activities, 2) the spills that have occurred are generally considered small, 3) as discussed previously, there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, 4) drilling vessels will be located at least 3 miles from shore in federal waters which further minimizes exposure of humpback whales and their habitat, EPA concludes that accidental spills that occur during oil and gas exploration will not result in measurable effects to humpback whales or their habitat.

5.4.3.3 Noise Disturbance from Vessels, Aircraft and Underwater Sound

Whether carried through the air or under water, noise may cause some species to alter their feeding routines, movement, and reproductive cycles (MMS 2003). In their biological opinions for the 3-D seismic program and Lease Sale 190 and 191 NMFS conducted a thorough analysis of the noise generated by support vehicles for these oil and gas exploration actions (NMFS 2003; NMFS 2012). They analyzed vessel traffic and aircraft noise and its effects on species within their purview.

In order to determine levels that may be resulting in harassment NMFS has been using generic sound exposure thresholds to determine when an action results in sound sufficient to affect marine mammals (70 FR 1871). Level A harassment from acoustic sources potentially begins at 180 dB_{RMS} isopleths, the onset of Level B is 160 db_{RMS} isopleths for impulsive noise and 120 dB_{RMS} from non-pulse noise. These levels pertain to categories of noise for cetaceans and pinnipeds. Impulsive sounds are not anticipated to be generated as part of this action, therefore only continuous sounds are considered.

Ship Traffic

Ship traffic associated with the support and operation of oil and gas facilities may pose an increased risk to humpback whales from elevated underwater sound (Table 9). Levels of underwater sound generated by vessels vary depending on the type and size of vessel. The expectation for this action is that small vessels will be used to support oil exploration, large commercial vessels and supertankers are not warranted as the proposed action permits discharges from exploration only. Therefore, as presented in Table 9 the noise levels anticipated being associated with oil and gas exploration in the action area ranges from 138 dB re 1 µPa to 140 dB re 1 µPa from the nearfield to 100 m. These levels exceed the Level B harassment of 120 dB_{RMS} of cetaceans.

Humpback whales have been observed attempting to avoid vessels and displayed such behavioral responses as aggressiveness, increased surfacing, or changes in dive patterns when approached by vessels (Richardson et al. (1995, cited in EPA 2012, pg 38). The behavioral responses range from avoidance to indifference (Richardson et al. 1995; Nowacek et al. 2001; Buckstaff 2004; Dole et al. 2008; all cited in BOEM 2012, pg. 4-347).

In order to avoid and minimize disturbance and direct ship strikes, when safe to do so the permittee will ensure that vessels will be directed to operate at a slow safe speed and in a purposeful manner transiting to and from work sites in as direct a route as possible. Marine mammal monitoring observers and passive acoustic devices will alert vessel captains as animals are detected to ensure safe and effective measures are applied to avoid striking a whale.

The range of humpback whales in LCI includes a portion of the action area at the entrance to Kachemak Bay. Boats accessing drilling vessels in this location may likely encounter humpback whales during the summer. It is likely that these encounters will be infrequent as humpback whales are wide-ranging species; only a small portion of their range is within the action area; and, the number of boat trips is expected to be low ranging from one to three per week. Any individual animal disturbed by the vessels will likely cease their normal behaviors, move away from the vessel and then likely resume their normal activities. Cessation of feeding for the time it takes for a vessel to move away is not likely to result in a reduction of fitness of the individual. Additionally, one to three vessels per week will not likely cause a significant disruption to the essential behaviors of humpback whales. Therefore, EPA concludes that underwater sound from vessel traffic will not result in measurable effects and is not likely to adversely affect Humpback whales.

Helicopters

Aircraft are also necessary support vehicles for transportation of workers and supplies. Most offshore air traffic associated with the oil industry relies on turbine helicopters flying along straight lines (NOAA 2003, pg. 28). Aircraft emit sound at in air sound pressure levels of are measured in dB re 20 µPa.

In addition to the angle the height above the water influences the reaction of whales. NOAA (2003, pg. 29) states that “fixed-wing aircraft flying at low altitude often cause hasty dives”. The reactions are at times obvious if the aircraft is flying at an altitude of 300m or less. NOAA, (2003) concludes that “the effects from an encounter with aircraft are expected to be brief, and the whales should resume their normal activities within minutes”. Observation of bowhead whales exposed to helicopter over-flights indicates that most bowhead whales exhibited no obvious response when the craft in above 150 m. Patenaude et al. (2002, pg. 309) observed that most reactions by bowhead whales to a Bell 212 helicopter occurred when the vessel was at an altitude of 150 m, or less and at a lateral distance of 250 m or less. The whales dove immediately upon repeated over flights (5 of 46) when the helicopter approached 15 m or less. The whales (52 individuals) did not react when a single over flight was made even at a distance of 250 m or less.

The range of humpback whales in LCI includes a portion of the action area at the entrance to Kachemak Bay. Aircraft accessing drilling vessels in this location may encounter humpback whales during the summer. Whales would likely only be disturbed when the aircraft is directly overhead or when the aircraft is flying at 300 m altitude and a lateral distance of 250 m or less. It is likely that these encounters will be infrequent as humpback whales are wide-ranging species; only a small portion of their range is within the action area; and, the number of flights is expected to be low ranging from one to three per week. Any individual animals disturbed by the aircraft will likely cease their normal behaviors and dive quickly, and then likely resume their normal activities within minutes. Noise generated by helicopters may have an effect on whales although information on the sensitivity of humpback whales is limited. In order to avoid and minimize disturbance of whales the permit will require that service helicopters follow the NMFS marine mammal viewing guidelines and regulations, and commit to altitude restrictions (staying above 1,000 ft) and avoiding flying directly over marine mammals.

In the advent that a whale reacts to the presence of aircraft cessation of feeding for the time it takes for the craft to move away is not likely to result in a reduction of fitness of the individual. Additionally, one to three flights per week will not likely cause a significant disruption to the essential behaviors of humpback whales. Therefore, EPA concludes that noise from aircraft will not result in measurable effects to essential behaviors of Humpback whales.

OFFSHORE DRILLING

Data are limited regarding the possible reaction of humpback whales to drill-ship noises; however Malme (1985) observed reactions among humpback whales exposed to drillship, semi-submersible, drilling platform and production platform noises. No response was observed in feeding humpback whales when they were exposed to noise levels from 116 to 124 dB re 1 µPa; this noise level caused behavioral disruption in bowhead and gray whales. The near-field measurements (127 dB re 1 µPa) above exceed these levels. Therefore, it’s possible that if humpback whales were to approach drilling vessels they would likely encounter noise levels that would cause them to respond, most likely by moving out of range so that the noise did not interfere with their communication and normal behaviors.

Blackwell and Greene (2002; cited in NOAA 2012, pg. 45) measured underwater sound produced at an oil platform and at six locations ranging in distance from 0.3 to 19 km. They found that the highest recorded sound level was 119 dB re 1 µPa at a distance of 1.2 km. NOAA (2003, pg. 22) cited another study that recorded noise from drilling so low as to be almost undetectable alongside the platform at sea states of three or above. The strongest tones were near 5 Hz and at the near-field locations were 119 to 127 dB re 1 µPa (Richardson et al. 1995 as cited in NMFS 2003, pg. 22).

The range of humpback whales in LCI includes a portion of the action area at the entrance to Kachemak Bay. As oil exploration increases in LCI humpback whales may encounter a drilling vessel during the summer. Whales would likely only be disturbed by noise from the vessel as they approach into the near field. It is likely that these encounters will be infrequent as humpback whales are wide-ranging species and only a small portion of their range is within the action area. Any individual animals disturbed by the drilling vessel will likely swim away (NMFS 2003, pg. 25), and then likely resume their normal activities at a distance that allows them to communicate and interact unobstructed. It is possible that the whales may be following prey which is moving uncomfortably close to a drilling vessels and the whale must abandon pursuit. However, it is unlikely that recurrent interruptions in feeding will occur given the limited range of this species within the action area. Therefore, EPA concludes that underwater sound from the drilling operations and vessel will not result in measurable effects to essential behaviors of Humpback whales.

5.4.3.4 Habitat Loss

The primary habitat utilized by the humpback whale is located in the Gulf of Alaska, in the vicinity of the Barren Islands and Kachemak Bay. A portion of the whale's distribution overlaps with the action area at the entrance to Kachemak Bay, but the majority of the habitat is outside of the action area or within the Bay where drilling is not permitted (Figure 8).

Additionally, because of the current patterns (to the southwest) and rapid deposition (within 50 to 100 m; 164 to 326 ft from the discharge point) drilling fluids and cutting are not anticipated to build up in the nearshore where the humpback whales will be foraging.

Therefore, because: 1) only a small portion of the humpback whales range is within the action area and 2) and drilling fluids and mud accumulation is not will not occur within Kachemak Bay, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable effects to humpback whale habitat.

5.4.3.5 Ship Strikes

Direct ship strikes are a significant source of mortality in some stocks of humpback whales (See Section 4.3.1.2). Humpback whales are the second (only to finback whales) most often reported cetaceans to be struck by vessels. The high reporting rate may be because humpback whales occur closer to shore and so carcasses are more likely to be observed (Jensen and Silber 2004, pg. 2). In 2001, NMFS issued regulations to prohibit most approaches to humpback whales in Alaska (66 FR 29501; May 31, 2001). These regulations stipulate that vessels must maintain a 100 m distance from a whale and that that vessels must maintain a "slow, safe speed" when a vessel is near humpback whales. These regulations are intended to protect whales from ship strikes and their implementation should result in avoiding impact. Additionally, when it is safe to do so vessels will operate at a slow safe speed and in a purposeful manner transiting to and from work sites in as direct a route as possible. Marine mammal monitoring observers and passive acoustic devices will alert vessel captains as animals are detected to ensure safe and effective measures are applied to avoid and minimize to marine mammals. Therefore, EPA concludes that the potential for ship strikes will not result in measurable effects to Humpback whales.

5.4.4 Fin Whale

As far as EPA can determine there have been no sightings of fin whales in the action area. According to NMFS (2003, pg. 14) fin whales "appear to congregate in the waters around Kodiak Island and south of Prince William Sound". Small numbers of these whales have been observed in Shelikof Strait. Apparently the coastal currents at the entrance to Cook Inlet provide upwelling which transports nutrients up into the water column increasing productivity of these waters and creating an attractive foraging opportunity for fin whales during the winter months (Mizroch et al. 2001 as cited in NMFS 2003, pg. 14). NMFS (2003, pg. 14) describes the locations where fin whales congregate offshore along frontal boundaries or mixing zones between coastal and oceanic waters at the 200 m isobaths.

5.4.4.1 Direct Discharges

Fin whales are present in Shelikof Strait at the entrance to Cook Inlet. To the best of our knowledge these whales do not enter into the action area. As such we do not expect them to encounter discharges. Therefore, EPA concludes that there is a low likelihood of exposure of fin whales to discharges authorized under the Cook Inlet Oil and Gas Exploration General Permit and so effects are considered discountable.

5.4.4.2 Oil Spills

There is an extremely low likelihood of a large oils spill resulting from exploration during routine operations (see Section 5.2.2). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is unlikely that fin whales will be in the vicinity of a drilling vessel during a spill event. This species is not anticipated to be in the action area; rather its feeding habitat is in Shelikof Strait. Therefore, EPA concludes that there is a low likelihood of exposure of fin whales to small oil spills in the action area so effects are considered discountable.

5.4.4.3 Noise Disturbance from Vessels, Aircraft and Underwater Sound

A detailed discussion on the anticipated level of noise generated by vessels, aircraft and drilling operations in presented in Sections 5.2.3.

The range of fin whales includes the waters around Kodiak Island and south of Prince William Sound.; they are not expected to occur within the action area. Boats and aircraft accessing drilling vessels in the action area will be using ports in Homer, Kenai and Nikiski so they are not expected to encounter nor fly over fin whales. Therefore, EPA concludes that noise from vessel traffic and aircraft will not disrupt essential behaviors of fin whales.

5.4.4.4 Habitat Loss

To the best of our knowledge fin whales do not utilize foraging areas within the action area. Additionally, although materials discharged in the action area are anticipated to move out of LCI into Shelikof Strait, by the time that this transport has occurred pollutants discharged from the drilling vessels will be so dilute as to be undetectable.

There is a low likelihood of an oil spill resulting from exploration (Section 5.3.2). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is unlikely that the effects from a small spill will reach Shelikof Strait where fin whales may be feeding.

Therefore, because: 1) fin whales are not anticipated to be in the action area, 2) airports are not located south of the action area, therefore no over-flights of fin whale habitat is anticipated, and 3) discharges are not anticipated to be measurable within Shelikof Strait and oil spills are likely to be minor and localized, EPA concludes that reauthorization of the Cook Inlet Oil and Gas General Permit will not result in measurable effects to fin whale habitat.

5.4.5 Cook Inlet Beluga Whale

Beluga whales are primarily found in upper Cook Inlet where they prefer shallow inshore water. They tend to travel along the shorelines focusing their hunting efforts on rivers and fish-bearing streams. When whales move between preferred locations they travel in shallow water along the coast in a brisk and directed fashion (Hobbs et al. 2005, pg. 338). Aerial surveys conducted during June and July over the past 20 years have repeatedly demonstrated that there is high use of Knik Arm, Turnagain Arm, Chickaloon Bay and the Susitna River delta in the upper Inlet; recent satellite tagging studies have confirmed these area preferences (NMFS 2008, pg 13).

Hobbs et al. (2005) used the satellite telemetry data to generate probability estimates for predicting the seasonal use (August through March) of Cook Inlet by the whales. According to their conclusions beluga whales do not enter the exploration action area. However, opportunistic sights have revealed that beluga whales will use Kachemak, Chinitna and Tuxedni Bays in the fall (Hobbs et al. 2005; NMFS 2008, pg. 16; Figure 7). These bays are within State waters adjacent to the action area in the lower Inlet (Figure 1). However, oil exploration activities will not occur in these Bays as they have been designated for protection (Section 2.4.1).

Movement of beluga whales in the upper and lower reaches of Cook Inlet varies with season and is related to prey dispersal (Hobbs et al. 2005, pg. 336). During the spring and summer the whales appear to be following eulachon and salmon runs and are regularly sighted in the upper Inlet beginning in April or early May. They utilize coastal areas, particularly near river mouths and tidal flats, and congregate near the Susitna Delta in summer preying on salmon runs; however, they also use the small streams along the west side of the Inlet at this time. During the fall the whales move to Knik Arm coinciding with the Coho run. In late autumn prey species are more dispersed reducing the group feeding behavior and causing the whales to disperse more widely in the Inlet (Moore et al. 2000; Moulton 1997; both as cited in Hobbs et al. 2005, pg. 336). The whales have a larger home range in winter than summer and are more widely distributed in the upper and mid-Inlet in winter (Hobbs et al. 2005, pg. 331, 334). According to Hobbs et al. (2005, pg. 336) "the spatial dispersal of prey means that winter feeding areas may be critical to the health and size of the beluga population".

The NMFS has been tracking the movement of beluga whales in Cook Inlet for a number of years and the data collected through those efforts was used to discuss the relationship between their habitat use and the action area.

5.4.5.1 Direct Discharges

EPA does not expect beluga whales to be directly exposed to discharges from oil and gas exploration operations in federal waters. This is primarily due to the fact that the whales do not use the action area where exploration is permitted (Figure 7) in LCI. The whales have been documented using the coastal areas and Bays on the west side of the Inlet and in the past have been found in Kachemak Bay (as discussed above), however discharges are not permitted in these locations. Furthermore, EPA does not expect the whales to be exposed to discharges occurring in federal waters due to the transport and fate of the discharges influenced by the hydrodynamic characteristics of LCI (Section 4.2.1).

Beluga whales would have to come within 100 m of the drilling vessels in order to be within the mixing zone. It's possible that they could swim through the mixing zone but would not be expected to remain in the vicinity for an extended period of time as the federal waters are 3 nm off shore and would not be close to river mouths or bays where belugas would spend time feeding. When traveling between destinations in upper Cook inlet beluga whales tend to move quickly (Hobbs et al. 2005, pgs. 333 and 338). If their movements were similar in the lower Inlet they would not be expected to remain close to an active drilling vessel.

Although direct exposure is not expected the potential for indirect exposure through the food web must be considered. Essential elements such as zinc, copper and selenium and potentially toxic ones including cadmium and mercury occur naturally, and the concentrations in marine mammal tissues may reflect natural geochemical and food web process. Animals are able to regulate these metals to some degree (Becker et al. 2000; URS 2010). Becker et al. (2000) further states that determining the sources of heavy metals and whether or how much is of anthropogenic in origin is more difficult than when evaluating organic chemicals which are all anthropogenic.

The potential for exposure depends on the bioavailability of the metals (discussed in Section 5.2.1). The metals with the highest propensity to bioaccumulate to toxic levels are cadmium, mercury, and selenium. Selenium and mercury are antagonists in that the bioaccumulation of mercury is reduced in the presence of selenium. These metals are present in drilling fluids, however; they are present in low amounts (Table 10). Other metals are present in drilling fluids that have been detected in beluga tissues from Cook Inlet. These other metals are not as potent but nevertheless can build up in kidney and liver tissues eliciting a toxic effect (Lavery et al. 2009).

Oil and gas exploration has been occurring for decades in Cook Inlet and in the upper Inlet where belugas spend the majority of their time. Therefore, EPA reviewed the tissue data for Cook Inlet beluga whales to explore whether the contaminants that are discharged by this industry are building up in the tissues of these whales. Unfortunately, the availability of tissue data is limited as the sampling that has been done has been through opportunistic means and without a systematic experimental design directed at source identification. Nonetheless, we used the data which was available to surmise whether the potential uptake of metals from drilling fluids was resulting elevated tissue concentrations in beluga whales resulting in indirect effects.

Organic and inorganic contaminants have been analyzed in beluga whales including the Cook Inlet stock (Becker et al. 2000; Reiner et al. 2012; Hoguet et al. 2013). The source of tissues is limited to two programs, the Alaska Marine Mammal Tissue Archival Project (AMMTAP) and the Arctic Monitoring and Assessment Program (AMAP). The tissues were analyzed for both legacy (PCB's and chlorinated pesticides) and emerging (fire retardants) contaminants, as well as heavy metals. We have only discussed the metals tissue burden as the discharges are not expected to contain the other pollutants listed.

Becker et al. (2000) analyzed a suite of metals, seven of which are found in clean drilling fluids and compared the levels measured in Cook Inlet beluga whales to belugas from the Arctic, Greenland, Arctic Canada and the St. Lawrence stocks. They report that "in the case of heavy metals and other elements, cadmium, mercury, and selenium were much lower in the livers of Cook Inlet animals than all other belugas, and vanadium and silver were lower in the Cook Inlet belugas than in the other Arctic Alaska belugas". Liver concentrations of cadmium (<1 mg/kg ww) and total mercury (0.7 to 11.4 mg/kg ww) were lower in the Cook Inlet beluga whales. Conversely, copper (3.97 to 123.8 mg/kg ww) was significantly higher in Cook Inlet whale stocks and silver was significantly higher in all Arctic whales suggesting a species-specific phenomenon for silver. Methyl mercury tissue concentrations were similar to other beluga stocks and did not exceed 2.11 mg/kg ww.

Hoguet et al. (2013) primarily focused on the spatial and temporal trends of persistent organic pollutants and mercury as these contaminants are aerial transported to the Arctic where they become a sink and source for transfer through the food web. The authors measured total mercury in livers of males and female beluga whales and found that the median concentrations were 6.14 mg/kg ww and 4.21 mg/kg ww, respectively. The tissue levels in Cook Inlet beluga whale stocks were lower than belugas from the eastern Chukchi Sea where the median concentrations were 16.3 mg/kg ww and 6.07 mg/kg ww for males and females, respectively. We should note that very little mercury is present in clean barite drilling fluid (Table 14).

Although metal concentrations are available for a number of marine mammal species very few studies have investigated the relationship between metals and toxicity. Lavery et al. (2009) investigated the metallothioneins concentration, renal damage and bone malformations in adult bottlenose dolphin carcasses to establish whether there was a relationship with the cadmium, copper and zinc concentrations in liver. The authors found a high level of variability among individuals in the toxicity markers (renal damage and bone structure). They used cluster analysis[15] to classify dolphins into two groups based on difference in renal parameters or indicators of renal damage (Lavery et al. 2009, pg. 3). The two groups were formed to characterize low and high scores for renal damage. These values are presented in Table 18 along with the renal metals data available for Cook Inlet beluga whales. These values should be viewed with caution due to the significant confounding factors associated with carcass studies. These natural experiments are challenged by these confounding factors (reproductive status, nutritive condition) which make it difficult to establish definitive toxicity thresholds. Nonetheless, the results provide valuable information which can be used to make inferences and guide future investigations (Lavery et al. 2009, pg. 6).

The AMAP established in 1991 to monitor pollution risks and their effects on the Arctic Environment is an important source of information. Assessment reports covering specific groups of chemicals and other environmental perturbations are published regularly. EPA reviewed the AMAP Assessment of Heavy Metals in the Arctic (AMAP 2002). This report included a section on toxicity thresholds for effects in marine mammals (AMAP 2002, pg 121; Table 18).

[15] A method for identifying individuals or objects similar to one another but different from individuals in other groups.

TABLE 18. CONCENTRATIONS OF METALS MEASURED IN ARCHIVED SAMPLES OF COOK INLET BELUGA WHALE LIVER (BECKER ET AL. 2000) COMPARED TO METALS MEASURED IN SOUTH AUSTRALIAN ADULT BOTTLENOSE DOLPHINS (TURSIOPS ADUNCUS)

Metal	***Mean Low Renal Damage Concentration (mg/kg ww)[a]***	***Mean High Renal Damage Concentration (mg/kg ww)[a]***	***Liver Damage in Marine Mammals (mg/kg ww)[b]***	***Mean Concentration in Male Cook Inlet Belugas (mg/kg ww)[c]***	***Mean Concentration in female Cook Inlet Belugas (mg/kg ww)[c]***
Copper[a]	16.02 ± 5.55	29.72 ± 9.18	N/A	**49.93 ± 39.79**	**29.26 ± 20.09**
Cadmium[a]	4.55 ± 6.27	37.00 ± 53.33	200	<1.0	0.63 ± 0.155
Lead	0.17 ± 0.13	0.12 ± 0.09	N/A	N/A	N/A
Mercury (total)	800 ± 637	1359 ±687	60	5.454 ± 3.474	2.568 ± 1.816
Selenium	291 ± 255	446 ±175	N/A	4.347 ± 1.567	2.620 ± 1.547
Zinc[b]	73 ± 37	178 ± 111	N/A	27.26 ± 2.265	24.38 ± 1.591

[a]: Lavery et al. (2009)

[b]:AMAP 2002

[c]: Becker et al. (2000)

[d]: Metal concentrations are significantly different between groups ($p < 0.05$)

URS (2010) conducted a literature search to evaluate the potential for a suite of chemicals to affect the reproductive success and recovery of the Cook Inlet beluga whale. The authors note the limited source of tissue data available to make these judgments. They focused their analysis of metals on those that "are generally considered to be of significant concern to organisms at the upper trophic level" such as the beluga whale. URS (2010, pg. 3-9) concluded that: 1) mercury concentration were below the AMAP (2002) threshold, 2) copper concentrations were substantially greater than the thresholds determined by Lavery et al. (2009), and 3) zinc concentration fell within the range of renal damage determined by Lavery et al (2002). We note however that URS was comparing the zinc liver concentration measured in dry weight against the Lavery value reported in wet weight. When you compare the wet weight values zinc is not elevated in beluga whale livers (Table 18). None of the other metals/metalloids measured in Cook Inlet beluga whale livers exceeded the thresholds presented in the literature; copper was the only metal which was elevated.

EPA also compiled fish tissue data to attempt to determine the amount of metals bioaccumulating in the food web (Table 15-17). According to the limited data for the few species that were available metals do not appear to be bioaccumulating in fish tissue and more broadly the food web.

As with any assessment of risk there is uncertainty associated with the predictions. In the current analysis we are relying on tissue data that was collected from Cook Inlet beluga whale, but these data are limited in number and were collected opportunistically from carcasses and not live animals. Additionally, we are comparing the tissue levels in the beluga whales to tissue levels from bottlenose dolphin and thresholds that were developed using other species under differing exposure scenarios (AMAP 2002; Lavery et al. 2009). These data (both tissue and toxicity) are not ideal for making an effect call on this imperiled species; however they are the only data available with which to conduct an assessment at this time.

Therefore, because: 1) Beluga whales are not expected to encounter direct discharges as they are not found in the action area, 2) metals discharged in drilling fluids do not appear to be bioaccumulating in beluga whale or fish tissue, and 3) the concentrations measured in beluga whale tissues are below effect levels and thresholds identified in Lavery et al. (2009) and AMAP (2002), EPA concludes that discharges authorized under the Cook Inlet Oil and Gas Exploration General Permit will not result in measureable direct effects to Cook Inlet beluga whale or indirect effects via prey.

5.4.5.2 Oil Spills

There is an extremely low likelihood of a large oils spill resulting from exploration during routine operations (see Section 5.2.2). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is unlikely that beluga whales will be in the vicinity of a drilling vessel during a spill event. This species is not anticipated to be in the action area, when in the lower Inlet it is found within bays and in the nearshore.

Therefore, because: 1) few spills result from exploration activities, 2) the spills that have occurred are generally considered small, and 3) as discussed previously, there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, EPA concludes that accidental spills that occur during oil and gas exploration will not result in measurable effects to Beluga whales.

5.4.5.3 Noise Disturbance from Vessels, Aircraft and Underwater Sound

See section 5.2.3 for a detailed description of disturbance from activities associated with exploration drilling.

EPA has extended the action area to the Forelands in order to insure that interrelated actions relating to the support of the drilling vessels are considered in the analysis (Figure 2). Specifically, this extended action area applies to the indirect effects of the movement of boats/ships and aircraft going to and from drilling vessels. The effects associated with these actions include underwater sound from ships and aircraft and the potential for vessel strikes.

Beluga whales may encounter support vessels and helicopters in the extended action area during winter when the whales are found in LCI (Figure 7). Patenaude et al. (2002) summarize the response of beluga whales to aircraft noise. Apparently, beluga response varies depending on the individual, its behavior at the time the aircraft are present and the altitude the aircraft are flying. The greatest response by beluga whales occurs when helicopters flew at altitudes less that 150 m (490 ft) and a lateral distance of less than 250 m (820 ft). The response was greater in individuals that were not feeding and involved "sudden dives, change in direction, change in behavioral state and displacement" (NMFS 2012, pg. 71).

Aircraft will be making one to three trips per week from the drilling platform to the landing site, most likely from Kenai or Nikiski. When en route to these destinations they will be flying over beluga whale critical habitat and locations where the whales are known to frequent during winter months.

During most of the year beluga whales will be in upper Cook Inlet and not within the action Area. However, during the winter the whales prefer deeper water in the North Foreland and LCI (Figure 7). It is when they are in these locations during the winter that they may encounter aircraft and vessels. It is possible that as many as 12 exploration wells may be drilled in the Action Area. Therefore, there may be 12 to 36 over flights and vessels trips through the extended action area per week.

In order to avoid and minimize impact to Cook Inlet beluga whales the service helicopters will follow the NMFS marine mammal viewing guidelines and regulations and commit to altitude restrictions (Staying above 1,000 ft) and avoiding flying directly over marine mammals. Additionally, service vessels will operate at a slow safe speed (when safety permits) and in a purposeful manner transiting to and from work sites in as direct a route as possible when in the vicinity of a beluga whale during winter (November through March) when the whale are anticipated to be in LCI. Marine mammal monitoring observers and passive acoustic devices will alert vessel captains as animals are detected to ensure safe and effective measures are applied to avoid and minimize beluga whale impacts.

Therefore, because: 1) during most of the year beluga whales will be in upper Cook Inlet and not within the action area, 2) service helicopters will follow the NMFS marine mammal viewing guidelines and regulations, and 3) service vessels will operate at safe speeds and avoid beluga whales; EPA concludes that disturbance from vessels, aircraft and underwater sound generated during oil and gas exploration will not result in measurable effects to Beluga whales.

5.4.5.1 Cook Inlet Beluga Whale Designated Critical Habitat

There are approximately 3,016 mi^2 (7,809 km^2) of critical habitat designated within two areas of Cook Inlet, of this only 1 percent is located within the exploration action area (Figure 7) [FR 76 20180]. There are fewer whales in Area 2 which is the area within the exploration action area, and they tend to be more dispersed. Overall, beluga whales spent 0.2 percent of their time in LCI. The remainder of Area 2 Critical habitat is located along the nearshore in State waters or in the northern part of the action area where vessel and aircraft traffic are anticipated to travel to and from the drilling platforms (Figure 7). Of the 5 PCEs listed for beluga whale only PCE # 2 and PCE #5 occur in the Action area:

PCE #2: Food, water, air, light, mineral, or other nutritional or physiological requirements.

PCE #5: Habitats that are protected from disturbance or are representative of the historic, geographical and ecological distribution of the species.

Discharges are not permitted in waters less than 10 m (33 ft) deep because discharges to shallow waters are less likely to be dispersed than discharges to deeper water. Discharge is prohibited in parts of Chinitna, Tuxedni, and Kamishak Bays because they are either areas of high resource value, or are adjacent to areas of high resource value. In addition, Kamishak Bay is a known net depositional environment where drilling fluid solids, cuttings, and other pollutants would likely accumulate if discharges are authorized in that area. This prohibition reduces the potential to impact the abundant aquatic life generally found in shallow waters and protects designated critical habitat in LCI.

There is an extremely low likelihood of a large spill occurring as a result of oil exploration. Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful.

The exploration action area is at least 3.5 miles from the mouths of the Ninilchik River, Deep Creek and Anchor River on the east coast of Cook Inlet; and Redoubt Creek, Crescent River, Johnson Creek and Shelter Creek on the west coast of Cook Inlet. Given the distance between the sources of permitted discharges and the mouths of these water bodies, dilution of the plumes will be in the order of 1,000:1 to 6,000:1 at 100m (300 ft) from the drilling vessel.

NMFS (2012, pg. 26; Calkins 1983, 1989) states that the area between the Forelands and Kalgin Island may be an important winter feeding area for beluga whales. This may be because the “narrowing of the Inlet in this area and the presence of Kalgin Island just south of the Forelands may result in upwelling and eddies which concentrate nutrients and may provide a still-water refuge for several migrating anadromous fishes” and late-winter staging area for eulachon. This potential winter feeding area is at least 5 miles from the exploration action area.

Additionally, waters in these areas will be free of contaminants in amounts that may be harmful to beluga whales. Currents and tides will facilitate mixing and dilution. Maximum surface current speeds average about 3 knots in most of Cook Inlet; however, currents may exceed 6.5 knots in the Forelands area, and have been reported at up to 12 knots in the vicinity of Kalgin Island and Drift River (KPB 2007a cited in USEPA and Tetra Tech 2013, pg. 28). The mixing of incoming and outgoing tidewater combined with freshwater inputs are the main forces driving surface circulation (MMS 2003).

It is highly unlikely that pollutants in the discharge over 3.5 miles from designated critical habitat will affect primary prey or water quality. The discharges will not create unrestricted passage between critical habitat areas. Finally, this area is not anticipated to be affected by discharges or noise emanating from drilling vessels due to the distance and resultant dilution.

EPA has extended the action area outside of federal waters. This extension is to ensure that the potential indirect effect of disturbance from aircraft and vessels is considered as part of the proposed action. Boats moving to and from drilling vessels are not anticipated to disrupt intertidal and subtidal habitat features or primary prey. These measures combined protect the biological features essential to the conservation of beluga whales.

The number of vessels trips may be as high as 36 per week if 12 drilling vessels are operating. Vessel operation results in the incidental discharge of petroleum hydrocarbons. However, the amount emitted from the vessels is not anticipated to be substantial enough to result in the discharge of toxins at amount which would be harmful to beluga whales.

There may be up to 36 over flights of helicopters in addition to the boat trips to and from the drilling vessels. While there may be some disturbance of beluga whales during the winter months (although this should be minimized through the implementation of conservation measures listed above), these trips are not anticipated to create unrestricted passage between critical habitat areas nor result in abandonment of critical habitat.

Therefore, because: 1) only 1 percent of designated critical habitat is located within the exploration action area, 2) Discharges are not permitted in waters less than 10 m (33 ft) deep, 3) there is an extremely low likelihood of a large oil spill occurring and any small spills that take place will likely be recovered, 4) dilution of the plumes will be in the order of 1,000:1 to 6,000:1 at 100m (300 ft) from the drilling vessel, and 5) conservation measures are in place to avoid and minimize the potential for ship strikes and disturbance from support vessels and aircraft, reissuance of the Cook Inlet Oil and Gas Exploration General Permit is not expected to adversely affect PCEs #2 and #5 and thus Cook Inlet beluga whale critical habitat.

5.4.6 Northern Sea Otter

Northern sea otter are prevalent in LCI and their distribution is fairly well represented by the designated critical habitat for this species (Figure 2). On the East shore of Cook Inlet, otters are common along the shoreline south of Nikiski, throughout Kachemak Bay, and along shorelines and in bays in the Port Graham/Nanwalek AMSA. Otters are most common along the shore and in shallow water, but can swim long distances and have been recorded in the middle of LCI. (K. Klein *in Litt*. March 2013).

Northern sea otters occur in nearshore waters which allow them access to subtidal and intertidal foraging habitats (Angliss and Lodge 2002, pg. 206). Visual observation of 1,251 dives by sea otters in southeast Alaska, indicates that foraging activities typically occurs in water depths ranging from 2 to 30 m (7 to 98 ft.), although foraging at depths up to 100 m (328 ft) was observed (Bodkin et al. 2004, pg. 305). Consistent with these depths otters are most commonly found in water a few kilometers from the shore and higher numbers of individuals are frequently associated with shallow water (Riedman and Estes 1990; Laidre et al 2002 both as cited in: USFWS 2010, pg. 2-4). However, sea otters are often found in high numbers where shallow water or islands occur offshore, such at Kalgin Island (Figure 2).

The home ranges of sea otters in established populations are relatively small. Sexually mature females have home ranges of 8 to 16 km (5 to 10 miles). Breeding males remain for all or part of the year within the bounds of their territory, which constitutes a length of coastline from 100 m (328 ft) to 1 km (0.6 mile). Male sea otters that do not hold territories may move greater distances between resting and foraging areas than territorial males (USFWS 2005).

5.4.6.1 Direct Discharges

See section 5.2.1 for a detailed description of the discharges associated with this general permit.

Sea otters are nearshore obligates and utilize habitats within 100 m of shore and in water depths up to 80 m (260 ft) but more generally 20 to 40 m (66 to 131 ft). They are found primarily in State waters and not within the action area. The area in the vicinity of Kalgin Island tends to be shallow (9.1 to 18.3 m; 30 to 60 ft) and otters may be prevalent in this location, but this area is also outside of the action area as is designated critical habitat for this species.

In the recovery plan for the Southwest Alaska DPS in referring to the OCS oil and gas lease sales in LCI and Bristol Bay the USFWS states:

> Based on a review of the draft Environmental Impact Statement for these sales, it is the opinion of FWS that "the potential impacts of this development on the southwest Alaska DPS will be negligible as sea otters occur primarily in the near shore zone and the lease sale area is at least three miles off shore. Therefore, sea otters do not significantly overlap with the lease sale area."

However, otters have been recorded in the middle of Cook Inlet and therefore it is possible that they will be in the action area for at least the time it takes them to traverse the Inlet, and so they may encounter discharges. The primary contaminants of concern for sea otters are petroleum products, oil and grease. Contaminants that will foul fur disrupting the otter's thermoregulatory ability and subjecting the animal to hypothermia. While these external physical effects are primary, ingestion of petroleum products can result in toxicity if the animal ingests a toxic dose while attempting to clean its fur. This general permit does not authorize production discharges which contain these contaminants. In addition, the discharge of petroleum products, oil and grease are also not authorized and measures are in place in the permit which avoid and minimize discharge of these materials (See Section 2.4.2).

The proposed Cook Inlet Exploration general permits require reporting of the total discharge volume of this waste stream and require that there is no discharge of free oil in the discharge. Any oil and grease or visual sheen triggers treatment, removal and disposal to an off-site facility. The prohibition, treatment and disposal of oil-based products should eliminate the discharge of materials which would foul the fur and alter the sea otters ability to thermoregulate.

It is highly unlikely that discharge from drilling vessels in federal waters three miles from shore would reach the coastline. Dilution of drilling fluids and cuttings within proximity of the drilling vessel is expected to be rapid up to 1,000:1 to 6,000:1 at 100 m (328 ft) with heavier materials settling out on the substrate and the dissolved fraction remaining in the water column. The concentrations of pollutants in the drilling fluids and cuttings will be very low and should not impact State waters or sea otter habitat.

Northern sea otters inhabit shallow subtidal and intertidal habitats, where they forage on a variety of marine invertebrates (e.g., crabs, clams and fish), and are often found in the vicinity of human activity centers. Thus they may potentially occur near drilling operations that are close to shore; it is unlikely that the otters would remain near a drilling vessel anchored three miles or more from shore unless it were is a shallow area that contained the preferred habitat features (e.g., kelp beds). The only area in

LCI that has “shallow’ mid-channel habitat is near Kalgin Island, and this location is outside of the exploration action area.

Therefore, because: 1) Northern sea otters are not expected to encounter direct discharges for any length of time as they do not routinely forage and loaf three miles from shore in the action area, 2) petroleum products, oil and grease, materials that will foul fur disrupting the otter’s thermoregulatory ability are not authorized for discharge and will be removed from the waste stream, and 3) discharge from drilling vessels in federal waters three nm from shore is not anticipated to reach the coastline and sea otter habitat, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas General Permit will not result in measurable effects to the Southwest DPS of the northern sea otter.

5.4.6.2 Oil Spills

See Section 5.2.2 for a detailed discussion on the potential for spill associated with oil and gas exploration activities. There is an extremely low likelihood of a large oil spill resulting from exploration during routine operations. Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful.

If a spill of magnitude occurs the ARRT has developed a plan to respond. Additionally, the ADEC has a Spill Prevention and Response Program which contains a Subarea Contingency Plan for Cook Inlet. This plan lays out the process for responding to a spill from implementation of the ICS to the prescriptive actions intended for protection of sensitive resources through the execution of Geographic Response Strategies for Cook Inlet (and elsewhere).

Oil spills are considered to be of moderate importance to the recovery of sea otters in Cook Inlet (Kodiak, Kamishak, Alaska Peninsula Management Unit). The majority of spills would be small and result in “limited local impacts” and the “management potential for prevention and containment of small oil spills is thought to be high” (USFWS 2010, pg. 4-1, 4-6). This is particularly true of the small spill occurred three nm from shore in federal waters. Unless an otter was swimming in the vicinity of the spill it is unlikely that the spilled material would travel the three nm to sea otter habitat where it could harm otters or their habitat.

Sea otters have been recorded in the middle of Cook Inlet and therefore it is possible that they will be in the action area for the time it takes them to traverse the Inlet. However, likelihood of the coincidence of an otter swimming within the action area with the occurrence of a small spill in the vicinity of a drilling vessel is remote. This species is not anticipated to be in the action area for an extended period of time, the habitat features fulfilling its biological requirements are found in the nearshore as represented by its designated critical habitat.

Therefore, because: 1) few spills result from exploration activities, 2) the spills that have occurred are generally considered small and would result in localized areas of impact, 3) as discussed previously, there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, and 4) northern sea otters are nearshore species and the likelihood that an individual would be in the action area when a spill occurred is low, EPA concludes that accidental spills occurring during oil and gas exploration will not result in measurable effects to the Southwest DPS of the Northern sea otters.

5.4.6. 3 Disturbance from Ships, Helicopters and Underwater Sound

See section 5.2.3 for a detailed description of disturbance from activities associated with exploration drilling. The behavior of northern sea otters could be affected by noise and other disturbance from the support vessels and helicopters. The most likely impacts to sea otters could be the disturbance of individuals that are hauled out, causing displacement of females and pups. Approximately one to three trips/well/week is anticipated. However, in winter boat traffic in remote regions could have local impacts on the distribution of females and pups; males, in comparison, appear to become accustomed to heavy boat traffic (MMS 2003).

According to USFWS (2010, pg. 3-27) because sea otters are slow swimmers in comparison to other marine mammals and they spend much of their time resting, grooming and nursing their pups, it follows then that they would be extremely vulnerable to disturbance by vessels. Curland (1997 cited in USFWS 2010, pg. 3-27) published a study on disturbance and reported that in locations where disturbance by power boats, divers and kayaks was prevalent sea otters traveled more often than individuals that were not exposed to these disturbances. Apparently, response varies depending on the season and sex of the animals and whether they have habituated to the disturbance or been harassed by it (hunting). Animals that are rafting when dispersed will disperse and not re-raft for many hours (USFWS 2010, pg. 3-27). However, disturbance from boat traffic is considered low as a threat to recovery of the sea otter. The rationale for this ranking in the recovery plan is because sea otter populations are highest and have thrived in areas that have the greatest amount of boat traffic (USFWS 2010, pg. 4-10).

EPA has not found any information indicating that aircraft flying overhead cause a response (neutral or negative) in sea otters. Monitoring of sea otters in LCI is performed through aerial surveys.

Noise from oil platforms (and presumably Jack-up rigs) is thought to be very weak due to the small surface area (the four legs) in contact with the water (Richardson 1995, cited in NOAA 2012c, pg 46). Additionally, the majority of the machinery is on the deck of the vessels which is above the water surface. However, noise is carried down the legs and can be detected for kilometers (Blackwell and Greene 2002 cited in NOAA 2012c).

Blackwell and Greene (2002; cited in NOAA 2012, pg. 45) measured underwater sound produced at an oil platform and at six locations ranging in distance from 0.3 to 19 km. They found that the highest recorded sound level was 119 dB re 1 µPa at a distance of 1.2 km. NOAA (2003, pg. 22) cited another study that recorded noise from drilling so low as to be almost undetectable alongside the platform at sea states of three or above. The strongest tones were near 5 hertz and at the near-field locations were 119 to 127 dB re 1 µPa (Richardson et al. 1995 as cited in NMFS 2003, pg. 22). The strongest tones listed in the near field exceed the marine mammal Harassment Level B of 120 dB_{RMS}. However, more recent data showed that the Harassment Level B for a continuous sound (the regulated threshold) was never measured (MAI 2011, pg. 29).

Therefore, because: 1) boat traffic doesn't appear to affect sea otters, as presented in the recovery plan, 2) the use of aircraft to monitor sea otters is a routine event, and 3) the recovery plan ranks disturbance as low as a threat to species recovery, EPA concludes that disturbance from vessels and aircraft will not result in measurable effects to the Southwest DPS of the Northern sea otter.

5.4.6.4 Habitat Loss

The primary and designated critical habitat utilized by the Northern Sea otter is within the nearshore to approximately 100 m from shore; this habitat does not overlap with the action area. Additionally, because of the current patterns (to the southwest) and rapid deposition (within 50 to 100 m; 164 to 326 ft from the discharge point) drilling fluids and cutting are not anticipated to build up in the nearshore where the sea otters will forage. Furthermore, discharges are not authorized in Kamishak Bay, Chinitna Bay and Tuxedni Bay for the protection of these sensitive resources. Therefore, sea otters utilizing the habitat in these bays will not be exposed to pollutants in the discharges.

Therefore, because: 1) designated critical habitat and other habitat used by otters for foraging and loafing are not present in the action area, 2) discharges are not permitted in sensitive areas and bays, and 3) drilling fluids, drilling muds and other materials in the discharges will be quickly diluted accumulation is not anticipated to occur in nearshore sea otter habitat, EPA concludes that discharges authorized under the Cook Inlet Oil and Gas Exploration General Permit will not result in measurable effects to sea otter habitat.

5.4.7 Steller Sea Lion

Rookeries and haulouts are the terrestrial habitat features that support reproduction, rest and refuge. These areas are well documented and rarely change, as their suitability for meeting the biological needs of the species depends on the location relative to substrate, exposure to wind and waves, human disturbance and proximity to prey resources (Mate 1973 as cited in 58 FR 45269). The Steller sea lion recovery plan discusses two types of distribution of this species, less than 20 km (12.4 miles) from rookeries and haulouts and areas greater than 20 km (12.4 miles) where individuals range to find optimal foraging conditions (NMFS 2008, pg. I-19). There are no rookeries in the action area; the nearest rookery is located on Sugarloaf Island which is in proximity to the Shelikof Strait foraging area.

An aquatic zone that extends 37 km (20 nm) seaward in State and federal waters from the baseline or base point of each major rookery and major haulout is also considered critical habitat and discharges are not permitted within this zone. The proposed general permit does not authorize discharges in the Shelikof Strait area and within 20 nm of Sugarloaf Island to protect the sea lions and their foraging habitat. Designated critical habitat includes an air zone that extends 0.9 km (3,000 ft) above the terrestrial zone of each major rookery and haulout area measured vertically from sea level.

5.4.7.1 Direct Discharges

It is highly unlikely that discharge from drilling vessels in federal waters would reach the 20 nm aquatic zones and impact major haulouts and rookeries, particularly because discharges are not permitted within this zone and dilution is rapid. Additionally, discharges are prohibited within 4,000 m of a coastal marsh, AMSA, State Game Refuge, state game sanctuary, critical habitat area or National Park further reducing the potential for exposure of sea lions and their prey. Distribution of males, females and juveniles after the breeding season will exceed 20 km but rarely 37 km (20 nm); additionally, foraging trip duration rarely exceeds 20 hours thereby reducing the potential for and duration of exposure.

The concentrations of pollutants in the drilling fluids and cuttings should not impact aquatic zones or areas where individuals would find optimal foraging (e.g. Shelikof Strait). Modeling has shown that dilution of drilling fluids and cuttings within proximity of the drilling vessel is expected to be up to 1,000:1 to 6,000:1 at 100m (328 ft) with heavier materials settling out on the substrate and the dissolved fraction remaining in the water column.

There are two haulouts along the west coast of Cook Inlet near Shelikof Strait that are not accompanied by a 20 nm aquatic zone (NMFS 2012, pg. 39). These haulouts are both outside of the Action area; however it is possible that sea lions would swim across the entrance to Cook Inlet to access Sugarloaf Island (Figure 8). If there was active drilling in this area it is possible that the sea lions could encounter a mixing zone, although exposure to the discharge would be short term (the time it takes them to swim 100 m). Sea lions would have to come within 100 m of the drilling vessels to be within the mixing zone. It's possible that they could swim through the mixing zone but would not be expected to remain in the vicinity for an extended period of time as the federal waters are three miles off shore and would not be close to haulouts these locations.

The proposed GP requires both reporting of the total discharge volume of this waste stream and that there is no discharge of free oil. Any oil and grease or visual sheen triggers treatment, removal and disposal to an off-site facility.

Although direct exposure is not expected the potential for indirect exposure from bioaccumulation through the food web must be considered. Essential elements such as zinc, copper and selenium and potentially toxic ones including cadmium and mercury occur naturally, and the concentrations in marine mammal tissues may reflect natural geochemical and food web process and animals are able to regulate these to some degree (Becker et al. 2000; URS 2010). Becker et al. (2000) further states that determining the sources of heavy metals and whether or how much is of anthropogenic in origin is more difficult than when evaluating organic chemicals which are all anthropogenic.

The potential for exposure depends on the bioavailability of the metals. The metals with the highest propensity to bioaccumulate to toxic levels are cadmium, mercury, and selenium. Selenium and mercury are antagonists in that the bioaccumulation of mercury is reduced in the presence of selenium. These metals are present in drilling fluids, however; they are present in low amounts (Table 14).

Baseline data has been collected to document the metals concentrations in Steller sea lion (pups) tissues (Holmes et al. 2008). One of the 162 animals sampled came from Sugarloaf Island all other animals were from southeast Alaska, the western Aleutian Islands and Russia. The authors measured aluminum, arsenic, cadmium, mercury lead silver and vanadium in blubber, brain, heart, kidney, liver, lung muscle, and testes. Of the metals measured all but vanadium are present in drilling fluids/muds (Table 14). The concentrations of aluminum, arsenic, silver, cadmium and lead were detected in ¼ to ⅔ of all the samples tested and were at levels at or below concentrations reported elsewhere in the literature

(Holmes et al. 2008). Mercury was detected at levels (9.38 µg/g) nine times the action level for fish (1 µg/g), however only 0.1 mg/kg mercury is present in "clean" drilling fluids as required by EPA. Aluminum was present at the highest concentration (17.92 ± 21.0 µg/g) compared to the other metals.

Aluminum is present in drilling fluids at elevated concentrations third only to barium and iron. Apparently, aluminum is rarely measured in marine mammal tissues even though the metal is a neurotoxicant (Holmes et al. 2008, pg. 1419). EPA searched the Web of Science and NOAA databases and was unable to locate any literature that discussed aluminum in Steller sea lion or pinnipeds for that matter. As a result, we are unable to comment on the bioavailability of aluminum; however, if it behaves like the other metals in barite as discussed by Crecelius (et al. 2007) we do not anticipate that it will build up in the aquatic food web. We are unable to comment on the effect on pups from the aluminum concentrations reported in Holmes et al. (2008) and because only one animal was collected from the vicinity of Cook Inlet it is premature to speculate further.

A significant amount of aluminum may be discharged along with drilling fluids/muds if this aluminum is bioavailable and bioaccumulates in aquatic species Steller sea lions (and other marine mammals) may ingest some proportion through their diet.

Therefore, because: 1) Steller sea lion are not expected to encounter direct discharges for any length of time as their foraging area is in Shelikof Strait, 2) discharges are not authorized within the 20 nm buffer around major rookeries and haulouts and within 4,000 m of other sensitive areas, 2) petroleum products, oil and grease, materials that will foul fur are not authorized for discharge and will be removed from the water stream, 3) discharge from drilling vessels in federal waters three miles from shore and outside of the 20 nm buffers is not anticipated to reach the coastline and Steller sea lion habitat, and 4) metals in drilling fluids and cuttings are have been shown (Tables 16 and 17) and are not expected to bioaccumulate, EPA concludes that discharges permitted under the Cook Inlet Oil and Gas Exploration General Permit will not result in measurable effects to Steller sea lions.

5.4.7.2 Oil Spills

There is an extremely low likelihood of a large oil spill resulting from exploration during routine operations (see Section 5.3.3). Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful.

If a spill of magnitude occurs the ARRT has developed a plan to respond. Additionally, the ADEC has a Spill Prevention and Response Program which contains a Subarea Contingency Plan for Cook Inlet. This plan contains the process for responding to a spill from implementation of the Incident Command System to the prescriptive actions intended for protection of sensitive resources through the execution of Geographic Response Strategies for Cook Inlet (and elsewhere).

Toxic substances including oil spills are considered to be medium with medium feasibility of mitigation to the recovery of Steller sea lions. The majority of spills would be small and result in "limited local impacts" and the "management potential for prevention and containment of small oil spills is thought to be high" (USFWS 2010, pg. 4-1, 4-6). This is particularly true of the small spill occurred three miles from shore in federal waters or 20 nm from rookeries and haulouts. Unless a Steller sea lion was swimming in the vicinity of the spill it is unlikely that the spilled material would travel the distance sea lion habitat where it could harm individuals or their habitat.

Steller sea lions may traverse the lower inlet traveling from the haulouts on the west coast to Sugarloaf Island. During this movement individuals may encounter a spill in the vicinity of a drilling vessel, however NMFS (2012, pg. 74) state that " Pinnipeds exposed to oil at sea through incidental ingestion, inhalation, or limited surface contact do not appear greatly harmed by the oil; however, pinnipeds found closer to the source or who must emerge directly in oil appear substantially more affected". The likelihood of the coincidence of a Steller sea lion swimming within the action area and the occurrence of a small spill in the vicinity of a drilling vessel is considered to be remote.

Because: 1) few spills result from exploration activities, 2) the spills that have occurred are generally considered small and would result in localized areas of impact, 3) as discussed previously, there are active plans in place to respond to oil spill in Alaska in general and specifically in Cook Inlet, and 4) the likelihood that an individual would be in the action area when a spill occurred is low, EPA concludes that accidental spills occurring during oil and gas exploration will not result in measurable effects to Steller sea lions.

5.4.7.3 Disturbance from Ships, Helicopters and Underwater Sound

A detailed discussion on the anticipated level of noise generated by vessels, aircraft and drilling operations in presented in Sections 5.2.3.

Boats, ships and helicopters will be servicing the drilling vessels. Behavior of Steller sea lions could be affected by noise and other disturbance from exploration drilling, support vessels, particularly helicopters. Sea lion pups are particularly vulnerable to trampling if adults are panicked by low-flying aircraft noise. This type of disturbance will be avoided by compliance with NMFS-specified flight practices; these include staying above 1,000 ft and avoiding flying directly over marine mammals and 0.9 km (3,000 ft) above the terrestrial zone of each major rookery and haulout area.

Displacement of individual sea lions of the western population from other important critical habitats (e.g., feeding areas), could potentially result in a significant effect on the population if alternative, equally valuable food resource were unavailable to them, or their shift to alternative areas displaced other Steller sea lions (MMS 2003). However, displacement from foraging areas would be prevented by avoiding vessel traffic in these areas. Federal waters covered under this general permit are located three nm from the shore; therefore all drilling and associated activities will occur at least this distance from rookeries and haulouts. Additionally, major rookeries and haulouts have a 20 nm buffer.

Ship traffic associated with the support and operation of oil and gas facilities may pose an increased risk to Steller sea lions from increased underwater sound (Table 9). Levels of underwater sound generated by vessels vary depending on the type and size of vessel. The expectation for this action is that small vessels will be used to support oil exploration, large commercial vessels and supertankers are not warranted as the proposed action permits discharges from exploration only. Therefore, as presented in Table 9 the noise levels anticipated being associated with oil and gas exploration in the action area ranges from 138 dB re 1 µPa to 140 dB re 1 µPa from the near-field to 100 m. These levels exceed the Level B harassment of 120 dB_{RMS} for pinnipeds. However, boats will be traveling to and from drilling vessels and should not be traveling into Steller sea lion habitat due to the restrictions discussed previously and the fact that federal waters are devoid of designated critical habitat. Should a sea lion be traversing the lower Inlet they may encounter a boat and respond by avoiding the craft. However, this avoidance will not likely result in a significant disruption of essential behaviors because the drilling and support vessels will be located within federal waters outside of designated critical habitat.

Aircraft are also necessary support vehicles for transportation of workers and supplies. Most offshore air traffic associated with the oil industry relies on turbine helicopters flying along straight lines (NOAA 2003, pg. 28). Helicopters flying at 150 m (492 ft) altitude are anticipated to emit noises received at ground level of 80 to 84 dB re 20 µPa (Born et al. 1999, cited in BOEM 2012, pg. 4-347). BOEM reports that fixed wing aircraft and helicopters produce noise levels of 156 to 175 dB re 20 µPa. The amount of sound transmitted through water depends on the flight angle from the vertical. When flying at angles greater than 13˚ from the vertical, the majority of incident sound is reflected without penetrating the water. The amount of underwater sound is greatest when the aircraft is overhead and at a 26˚ cone above the animal. Aircraft are restricted from both flying directly overhead of marine mammals and maintaining an altitude of at least 1,000 ft.

Noise from oil platforms (and presumably Jack-up rigs) is thought to be very weak due to the small surface area (the four legs) in contact with the water (Richardson 1995 cited in NMFS 2012, pg. 46). Additionally, the majority of the machinery is on the deck of the vessels which is above the water surface. However, noise is carried down the legs and can be detected for kilometers (Blackwell and Greene 2002 cited in NMFS 2012, pg. 46).

Blackwell and Greene (2002 cited in NMFS 2012, pg. 45) measured underwater sound produced at an oil platform and at six locations ranging in distance from 0.3 to 19 km. They found that the highest recorded sound level was 119 dB re 1 µPa at a distance of 1.2 km. NOAA (2003, pg. 22) cited another study that recorded noise from drilling so low as to be almost undetectable alongside the platform at sea states of three or above. The strongest tones were near 5 hertz and at the near-field locations were 119 to 127 dB re 1 µPa (Richardson et al 1995 cited in NMFS 2003, pg. 22).

Because: 1) disturbance from aircraft will be avoided by compliance with NMFS-specified flight practices, 2) displacement from foraging areas would be prevented by avoiding vessel traffic in these areas, 3) exploration and support activities will take place in federal waters outside of designated critical habitat, EPA concludes that disturbance from underwater sound generated by vessels, aircraft and exploration drilling will not result in measurable effects to Steller sea lions.

5.4.7.4 Habitat Loss

Designated critical habitat is not located within the action area rather important foraging habitat is in Shelikof Strait. There are buffers in place (20 nm and 4,000 m) intended to avoid both discharges and disturbance in designated critical habitat. Additionally, although materials discharged in the action area are anticipated to move out of LCI into Shelikof Strait, by the time that this transport has occurred pollutants discharged from the drilling vessels will be so dilute as to be undetectable. Finally, bioaccumulation of metals from drilling fluids and cuttings appears to be low based on the available data (Tables 15 -18).

There is a low likelihood of an oil spill resulting from exploration. Rather, the expectation is for small spills caused by the transfer of fuel and fluids from transport vessels to the drilling vessel and spills on the vessel deck. Small spills have occurred but the volumes have been low and recovery successful. It is unlikely that the effects from a small spill will reach rookeries or haulouts at least 3 nm from federal waters.

Therefore, because: 1) discharges are not anticipated to be measurable within sea lion critical habitat, nor are metals in the drilling fluids anticipated to bioaccumulate in the Steller sea lion food web, and 2) the low likelihood that small spills will reach rookeries or haulouts at least 3 nm from federal waters, EPA concludes that reissuance of the Cook Inlet Oil and Gas General Permit will not result in measurable effects to Steller Sea lion habitat.

5.5 Determination of Effect

The federal action that is the subject of this BE is the reissuance of the Cook Inlet Oil and Gas Exploration General Permit. The analysis of effects in this BE assumed that the species of interest are exposure to conditions that will exist of the NPDES permit conditions are met. Potential effects arising from violations of permit conditions were not evaluated. The determinations of effects for the seven ESA-listed and candidate species are presented in Table 19.

TABLE 19. SUMMARY OF EFFECT DETERMINATIONS FOR SPECIES AND DESIGNATED CRITICAL HABITAT

Species	**Population/Stock**	**Species Determination**	***Critical Habitat Determination***
Steller's Eider (*Polysticta stelleri*)	Alaska	NLAA	NA
Kittlitz Murrelet (*Brachyramphus brevirostrus*)	Alaska	NLAA	NA
Fin Whale (*Balaenoptera physalus*)	Northeast Pacific	NLAA	NA
Humpback Whale (*Megaptera novaeangliae*)	Central/Western North Pacific	NLAA	NA
Beluga Whale (*Delphinapterus leucas*)	Cook Inlet	NLAA	NLAA
Northern Sea Otter (*Enhydra lutris kenyoni*)	Southwest Alaska	NLAA	NLAA
Steller Sea Lion (*Eumetopias jubatus*)	Western	NLAA	NA

6.0 CUMULATIVE EFECTS

Cumulative effects include the effects of future state, tribal, local, or private actions on endangered and threatened species or their designated critical habitat that are reasonably certain to occur in the action area considered in this Biological Evaluation. Recreation and commercial uses of the Cook Inlet basin include sport fishing and hunting; fish processing, guide services, timber harvesting and restoration, mining and reclamation, agriculture and aquaculture, recreation and tourism, and public works projects, along with oil and gas exploration and development. Of these, oil and gas development is the main agent of industrial-related change in the Cook Inlet area.

Oil and gas exploration and production activities have occurred in the Cook Inlet basin for more than 50 years. In the late 1950s and the 1960s, several commercial oil and gas fields were discovered. Many of the commercial-sized fields discovered during that time are still producing today. Cook Inlet oil production peaked at 230 thousand barrels per day in 1970 and declined by almost an order of magnitude to 27.5 thousand barrels per day by 2003. Oil production in Cook Inlet is expected to continue to 2016. Cook Inlet natural gas production reached 217 billion cubic feet (bcf) per year in 1984, and peaked at 223 bcf in 1996. Natural gas production has remained relatively stable at an average of 213 bcf per year from 1997 to 2001. Natural gas production in Cook Inlet is expected to continue beyond 2022 (ADNR DOG 2004 as cited in Tetra Tech 2006).

The cumulative impact analysis considers the past and current lease sale activities; past oil and gas exploration and production; oil and gas discoveries that have a reasonable chance of being developed during the next 15 to 20 years; and speculative exploration and development of additional undiscovered resources (onshore and offshore) that could occur during the next 15 to 20 years.

Approximately 84,000 bbl[16] of drilling fluids and 98,000 bbl of drill cuttings would be discharged each year from oil and gas exploration and development drilling operations in Cook Inlet during the 5-year permit term (assuming a total of 14 wells in the State and federal waters). State waters in Cook Inlet contain 16 platforms, 12 of which are currently active. The State of Alaska currently has active oil and gas lease with 2 exploration operations underway in the 2012 drilling season. The most recent state oil and gas lease sale held in May 2012 included 197,795 acres.

Oil production in Cook Inlet has been steadily declining since 1990 and reduction in the movement of oil in Cook Inlet has been or will be offset by the increased movement of imports (Cape International Inc. and Nuca Research and Planning Group 2012, pg. 43). The majority of future actions will take place in upper Cook Inlet outside of the action area (Cape International Inc. and Nuca Research and Planning Group 2012). However, access to the expanded facilities and resources cannot be accomplished over-water without traversing the action area.

Over the next decade vessel traffic is anticipated to remain level or show only a moderate increase (1.5% to 2.5 % annually) (Cape International Inc. and Nuca Research and Planning Group 2012). Future development outside of the action area could result in an increase in vessel traffic but the likelihood of

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[16] Amounts from Furie on an annuals basis for the 5 year permit term.

these developments coming to fruition is questionable; they include, the facilities at Port MacKenzie and Ladd's Landing for coal and mineral export. These developments could cause an increase of at least 200 additional bulk cargo carrier port calls annually. While these developments are not within the action area the vessels would be transiting through the area.

The Port of Anchorage is currently undertaking an intermodal expansion project to accommodate economic and population growth in Alaska; assumed to be 1.2% per year for through 2014. The Port MacKenzie development project is a robust plan for commodity export and import through Cook Inlet. Commodities would include coal, low sulfur diesel, forest products, imports for the Alaska gas pipeline and mineral exports from future mining activity.

Development of the Ladd's Landing and Chuitna Coal Project could increase vessels traffic within the next 10 years. Although speculative, vessel traffic to and from Williamsport will increase if the Pebble Mine project and a proposed granite mine are developed (Cape International Inc. and Nuca Research and Planning Group 2012, pg. 41). These projects would require landing craft and construction traffic to ferry supplies from Homer, Alaska.

Although most of the economic development activities will take place in upper Cook Inlet, access to resources discussed above will involve movement through the action area. Therefore, there is the potential for disturbance of marine mammals and birds, marine mammal ship strikes, oil and material spills and increased chemical inputs to the lower Inlet from vessel discharges.

The likelihood of and timelines for the projects discussed above coming to fruition in the forseeable future is speculative. At present oil and Gas development has been and is still in a state of decline, reducing impacts to ESA-listed and candidate species. The other projects depend heavily on the condition of the United States economy which is in slow recovery. Therefore, for the 5-year term of the general permit EPA does not expect any significant increase in cumulative effects within the action area.

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APPENDIX I: FIGURES

FIGURE 1. AREA COVERED UNDER THE DRAFT GENERAL PERMIT

FIGURE 2. ENVIRONMENTAL BASELINE

FIGURE 3. STELLER SEA LION DESIGNATED CRITICAL HABITAT

FIGURE 4. ACTION AREAS

FIGURE 5. LAND OWNERSHIP AROUND COOK INLET

FIGURE 6. OIL AND GAS ACTIVITY 2012 IN COOK INLET

FIGURE 7. COOK INLET BELUGA WHALE PRESENCE NEAR THE ACTION AREA

FIGURE 8. SPECIES PRESENCE IN THE ACTION AREA

APPENDIX II: LIGHTING RECOMMENDATIONS